THE JOURNAL OF GAS LIGHTING
WATER SUPPLY & SANITARY IMPROVEMENT

VOL. LXVIII. No. 1731.] LONDON, JULY 14, 1896. [48TH YEAR. PRICE 6d.

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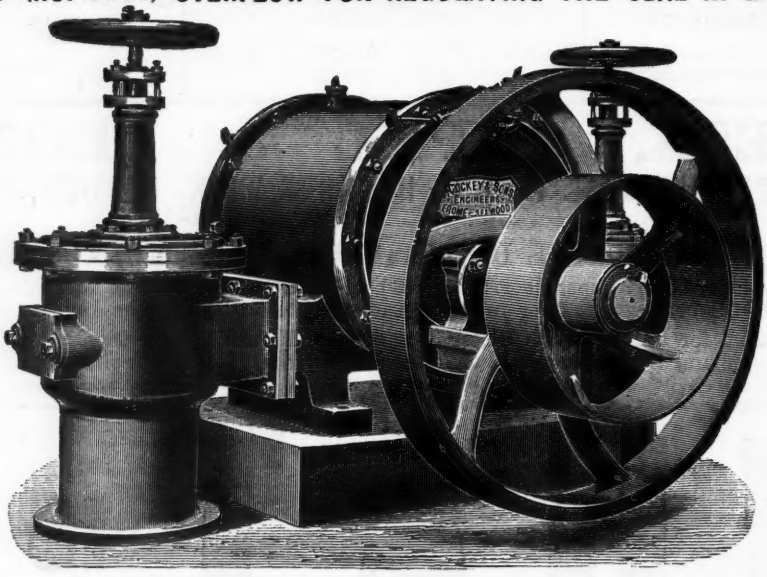

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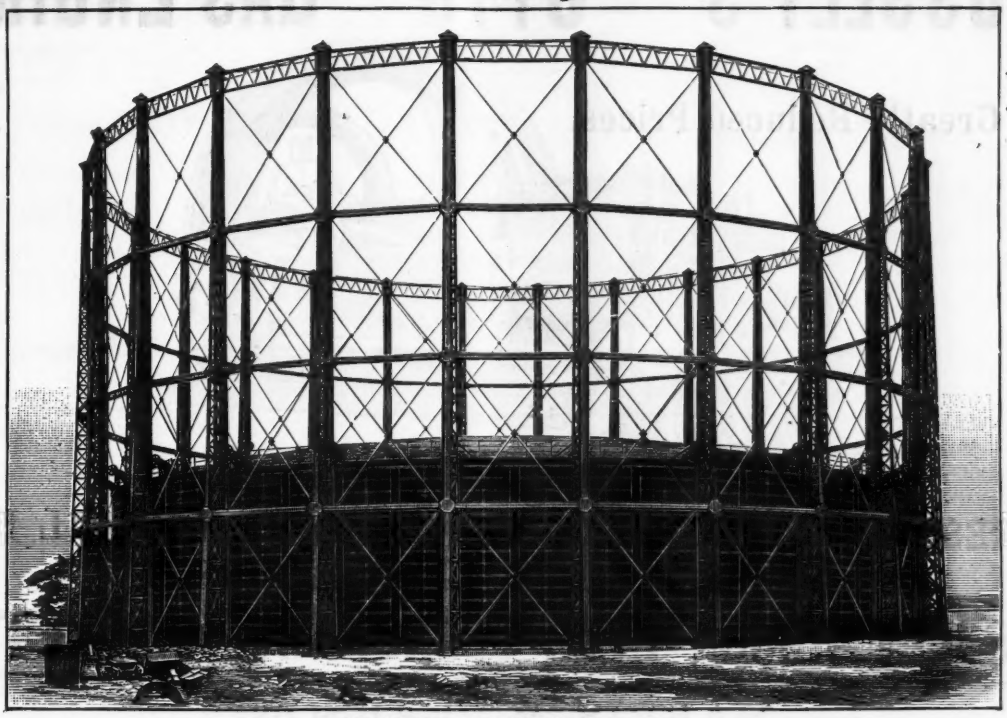

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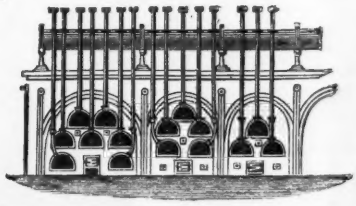

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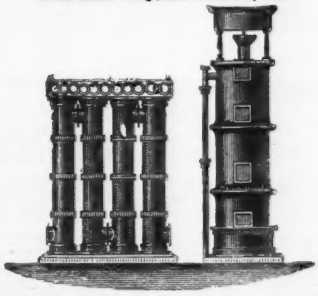

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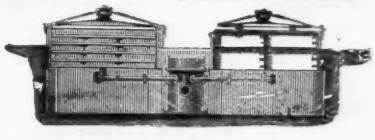

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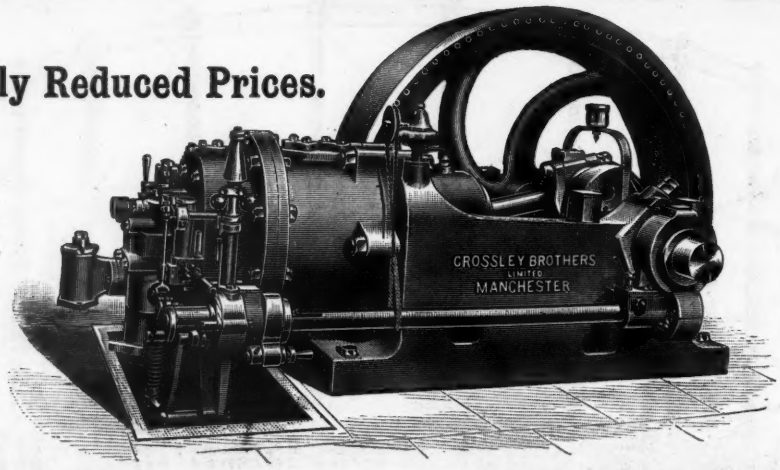

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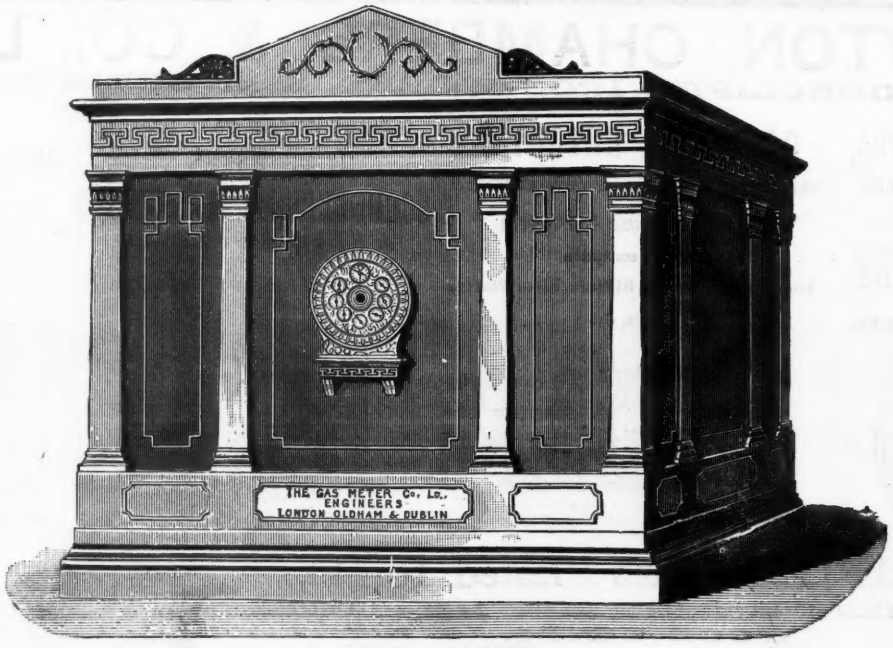

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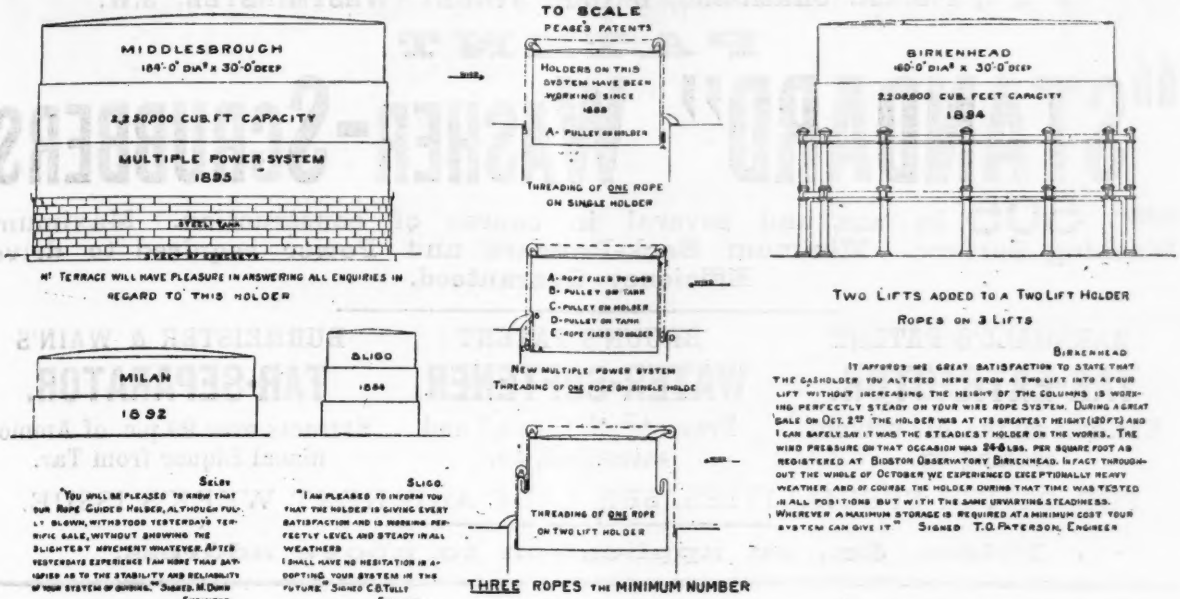

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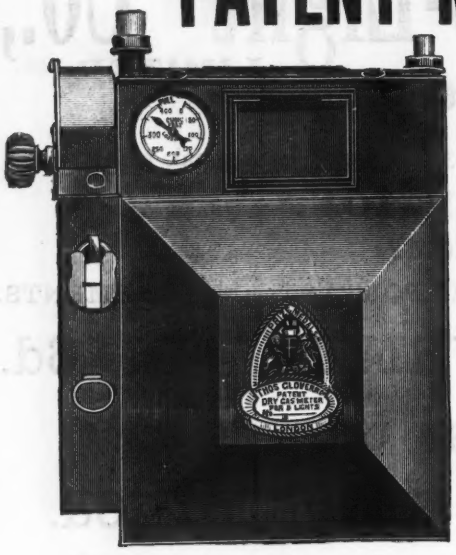

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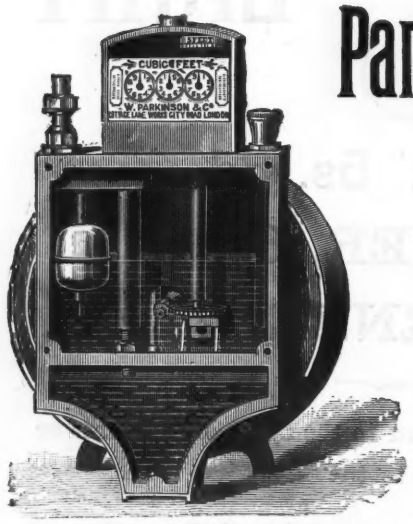

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EDITORIAL NOTES.

Brooding Trouble in the Coal Industry.

TROUBLE appears to be brewing for the coal trade; but when it will break out, and what will be the extent of it, are matters still "upon the knees of the gods." The newspapers have given publicity of late to almost daily reports of conferences and ballotings among employers and colliers in different parts of the country, pointing to the existence of serious disagreement with regard to the condition and prospects of the trade. The Northumberland and Durham miners have decided by ballot to withdraw from the Conciliation Boards for these counties, as from the end of the year; but, although the accountant's ascertainment of prices shows a slight reduction, the coalowners are not asking for any reduction of wages. Our Northern Correspondent's reports do not lend themselves to the idea that the gas coal trade is in a bad way, or that any immediate result may be expected to ensue upon the action of the men. But matters are different in respect to the coal-yielding districts controlled by the Miners' Federation, and regulated up to the present by what is known as the Rosebery Settlement, which expires at the end of the current month. The Conciliation Board constituted under this agreement—consisting of representatives of employers and workmen in equal numbers, with Lord Shand as independent Chairman—met recently to receive two propositions, emanating from the coal owners and miners respectively. The former was for a 10 per cent. reduction of wages, and the continuance of the Conciliation Board for another year. The miners' executive proposed that the Concialition Board should be continued for seventeen months longer in its present form; that during this period no increase of wages should be demanded; but at the end of the time, if it is thought necessary, a rise should be asked for. Between positions so opposite, there seemed from the first no hope of finding a middle way. A meeting of the parties nevertheless took place in Westminster on Wednesday last, at which (according to the report issued to the Press) the coalowners "renewed" the proposal "that the Conciliation Board inaugurated at the "Rosebery Conference, and as now established in con-"formity therewith, be continued—to determine from time "to time the rate of wages on and from August 1, 1896." It will be noticed that the suggestion of a 10 per cent. decrease of wages does not appear in this formula, although it was the crucial point upon which the Federation executive had balloted the men—who, of course, rejected the proposal. The men's representatives declined to accept the employers' amended proposition; but they offered an amended counter-proposal of their own, which was: "That the Board be continued for two years; that wages "remain as they are now for the next seventeen months, "and that no advance be asked for during that period; "but during the last seven months of the two years the "workmen to be at liberty to ask for an advance in wages." This in turn was rejected on behalf of the employers.

Press reports of subsequent interviews with the representatives of both parties tend to explain the position thus created. Messrs. Barnes, Deacon, and Salmond, representing Nottinghamshire, Derbyshire, and Leicestershire coal-fields on the Conciliation Board, are reported to have stated "that, whatever the official report might say, the "result of the meeting was that the Conciliation Board "was to be discontinued because the men would not agree "to its continuation under the conditions on which it was "started." The same speakers, however, made the further declaration (as reported) that, "whether the Board were "continued or not, they should demand a 10 per cent. "reduction on the 31st of this month." No general agreement on this head is reported. On the other hand, another newspaper report—given, it is true by the Socialistic "Daily Chronicle"—represents the miners as standing "firmly and as one man to the minimum wage, and that "minimum wage to be 30 per cent. above the 1888 "standard." Whatever may be in the minds of professional Trades Union leaders, it is fair to them to state that no nonsense of this kind appears upon, or is fairly deducible from, the record of their meeting on Thursday, which was held to consider the result of the meeting of the Board the previous day, and decide upon a plan of action. It is, of course, open to any firm of coalowners to declare that their circumstances forbid their keeping their

pits open unless the men will accept a 10 per cent., or any other, reduction—just as it is for the men to refuse such terms. Nothing is to be gained by complicating the issue with that of the acceptance of the vague Socialistic generality termed the "living wage."

Whether or not the proposed or any other reduction is to be insisted upon by all or sundry of the coalowners, it seems a pity that they said anything about it, as they were not prepared to take a stand on the question. Neither side seems to have treated the Conciliation Board quite fairly. The employers, by coupling the two questions of the necessity for a 10 per cent. reduction of wages and the continuance of the Board itself, gave the miners to understand that the latter implied the former. Similarly, the men, by declining to entertain any other idea of the function of the Board than that of approving an advance of wages, tempted the employers to think that such a body might with advantage be dispensed with. Meanwhile the key of the situation is given succinctly by our Lancashire Correspondent in his report, for the 30th ult., on the local coal trade. If his remarks on this occasion mean anything at all, they imply that "cut-throat competition" is for the present the rule in the market. It is idle to talk of fixed rates of wages while coal is sold for anything it will fetch. The men declare that they will not be made to suffer for this cause; and it is impossible to refuse them sympathy in their contention. The difficulty lies in making it effective. The state of things revealed by our correspondent, in the matter-of-fact terms of a market report, throws more light upon the condition and prospects of the coal industry than all the orations and vapourings of Socialists ever did, or ever will, supply. The pity of it is that the facts are the last things to be studied or regarded by those who profess a desire to improve the miner's condition, which can only be done by benefiting the employer also.

The Root of Sound Municipalism.

Mr. Joseph Chamberlain, M.P., presided last Wednesday at a banquet given in Birmingham to celebrate the raising of the Chief Magistrate of the City to the dignity of Lord Mayor. It was a very grand occasion, by all accounts. Birmingham did its best in honour of its new Lord Mayor, and honoured itself in so doing. There can be no question as to the desirability of investing municipal life with all possibly dignity; and Birmingham has done more than merely live up to a lofty municipal standard—it has largely helped to create it. There is an important aspect of provincial municipal life which was well envisaged by Mr. Chamberlain on this occasion—it is only by developing all the possibilities of this life that the individuality of provincial centres can be preserved. When Dublin and York stood alone, outside London, as possessing Lord Mayors, provincial life was very different from what modern facilities of communication with the capital have since made it. No provincial centre can ever again be the headquarters of fashion, intellect, or amusement. The best of everything that is portable is sent to London; and if everything belonged to this category, it would be a bad thing for the Provinces. Happily for the State, this realm of England possesses many interests that are not transferable to London; and of these are the sources of the prosperity of our largest and most progressive towns. The municipalism of these towns is no artificial thing, but a realization of an element in the national life which is not to be found elsewhere—certainly not in London. In whatever respects the Imperial capital may surpass the most important provincial town, there is hardly such a town in any part of the country that does not possess a more truly representative municipal authority than anything that the Metropolis can show. And this is almost necessarily so; for London is so big that no man knows his neighbour, whereas there is no other centre of population in the land large enough to allow men to lose their identity.

Municipalities, properly understood and inspired, have it within their power to do more for their communities than any other institution of government. As Mr. Chamberlain observed, "there is hardly anything too great or too small "for the work of these great corporations in our provincial "cities; and all men, to whatever class they belong, what-"ever may be their intellectual or other capabilities, may "find ample scope for an honourable ambition. The highest "ambition that any man can entertain is to leave the "world a little better than he found it; and it seems to "me that the municipal institutions of the country are the "most potent instruments that politicians have yet devised "for adding to the welfare, the prosperity, and the happiness "of the whole community." Mr. Chamberlain did not omit to descant a little upon the shadows of the picture. He referred to the temptation which besets leading members of communities to leave the worries and pains of municipal duty to others; reminding his hearers that the success of municipal institutions depends entirely upon three essentials —the character and ability of the elected representatives of the ratepayers; the ability and integrity of the permanent officials; and the intelligent interest in municipal work of the bulk of the electorate. One chord struck by Mr. Chamberlain on this occasion will vibrate in the hearts of many of our readers. He declared it to be a matter of the greatest importance to municipalities that the permanent officials and heads of departments ought to be the ablest and most skilful that love or money can procure. "There is no economy—I wish I could impress this more "deeply upon the minds of my fellow-citizens—there is "no economy more disastrous than the economy which "endeavours to make cheese-paring savings in the "remuneration of men whose services may be priceless. "Why, there is not at this moment a single great official "of the Corporation of Birmingham who by a single error "might not cost the ratepayers and the town more money "than tenfold the amount of his salary. You cannot "afford to have second-rate officials; and if you want "to have first-rate officials, you must pay the price that "competition has established for that particular kind of "service. . . . To my mind, one of the dangers which "at the present time threaten our municipal institutions "is the readiness of some of our ratepayers and electors, "acting upon an entirely mistaken notion, to accept second-"rate services in order to avoid paying first-rate salaries. ". . . It is false economy and an unwise policy to "do anything which would either detach from your service, "or prevent from entering into it, the highest ability, the "most conspicuous talent." This is statesmanlike talk, which ought to find an echo in every corporation council chamber in the world. The evil of bad pay for poor municipal service is, after all, attributable to the fundamental weakness mentioned by Mr. Chamberlain—that is, the leaving of so much municipal office to small and mean men. Where this mischief has been done, every other undesirable result is certain to appear, sooner or later.

A Massachusetts Gas Scheme Vetoed.

In the "Journal" for April 14 last we commented upon a new gas supply scheme, of a somewhat remarkable character, which certain philanthropists sought to launch upon the unsophisticated population of Massachusetts. We now learn that the Bill incorporating a Company to carry out this scheme, under the style and title of the Massachusetts Pipe Line Company, duly passed the State Legislature, but was vetoed by the Acting-Governor, Mr. Roger Wolcott, in terms that give one decided respect for this gentleman, although by implication they exhibit the State Legislature in a very unfavourable light. Mr. Wolcott was able to see farther through the scheme than most of the State legislators appear to have been capable or desirous of doing. The promoters of the project might call their Company by whatever title they chose; but Mr. Wolcott saw in it only another competing gas scheme, of a particularly brazen character, for the victimizing of the unfortunate public. He saw through the Bill, and he also saw through the promoters. Moreover, he very cleverly turned the tables upon them by suggesting that these enterprising gentlemen might begin by exhibiting the general advantages of their proposed coke-oven gas pipe-line in connection with their own Boston gas business. "It "will be time enough, in my judgment," says the Acting-Governor, "to grant the exceptional privileges of this Bill "when, in the field now controlled by them, they shall "have been able to verify the claims, upon the mere "promise of which they ask for this Bill." Such an argument is destructive of all high and philanthropic proposals, when the proposers are known. Mr. H. M. Whitney and his associates in this business evidently ought to have gone where they would have been among strangers. Notwithstanding this rebuff, the promoters tried again; the rules of the State Legislature evidently being of a nature to encourage applicants for statutory powers to come as often and as frequently as they like, until they get what they want. So after all the Massachusetts Pipe Line

Company got a Bill through, which the same watchful Acting-Governor did not think it worth while to quash. Whether or not anything will come of it, remains to be seen. It may, however, be doubted that the road taken by these enterprising promoters is the way to cheap gas for Massachusetts. If, meanwhile, they fall in with the sense of Mr. Wolcott's criticism, and commence their philanthropy at home in Boston, it would be a guarantee of good faith.

The Canker of Commerce.

An extremely interesting and important case was disposed of on Monday of last week, after a hearing of several days' duration, by the Lord Chief Justice and a special jury. The action was brought by the well-known London furnishing house of Messrs. Oetzmann and Co., against a firm of Sheffield cutlers, to recover the amount of certain overcharges and secret commission improperly paid to plaintiffs' buyer, since dead. In the course of the proceedings, a good deal came out respecting the relations between the buyer and a travelling member of the defendant firm. It was shown that these relations were apparently of an intimate character, such as might exist between old and staunch friends of equal social standing. Moreover, it appeared that the wholesale gentleman from Sheffield was of so free and easy a disposition, that he was not only willing to make a personal friend of an individual employee of his customers, but was open to entertain any other person similarly situated who might come to him in a social way. Interviews at hotels, and correspondence, marked "private," between these amicably-disposed persons seemed to be ordinary incidents of the prosecution of this particular branch of Sheffield trade; and there was also mention of pleasure trips to the seaside, and other mutual unbendings of the commercial bow, which somehow did not interfere with business. In the nature of things, knowledge of these "goings on" would not come to the purchasing firm; but in this case their buyer was stricken with a mortal sickness, and before he died he confessed to having been in the habit of receiving illicit commissions on orders given through him to the Sheffield firm. There is a touch of pathos, of the old-fashioned kind, about this part of the story, which comment would only spoil. Having successfully set a trap for the wholesale man, with the object of obtaining corroboration of their employee's confession, Messrs. Oetzmann and Co. next took proceedings for recovering the money of which they considered they had been defrauded in this way, and for exposing the iniquitous system. The action was stoutly defended; but the jury found for the plaintiffs after some strong language in condemnation of the commission system had been uttered by the Judge. It seems to be the Lord Chief Justice's fate to have to deal with cases of this character. He had one before him early in the year, upon which we commented in the "Journal" for Feb. 18 last. Curiously enough, the evidence in the recent case illustrates one of the points made in our earlier commentary, when we counselled those whose positions expose them to suspicion to diminish the risk by "keeping business connections in their proper place." We argued on that occasion that "it is better for a public officer to condemn himself to a life of isolation than to be too free in associating out of business hours and business places with commercial men." This is, of course, putting the matter strongly; but in this connection easy-going counsels are worse than valueless. The Lord Chief Justice said on the last occasion that "these corrupt bargains are malignant cankers. It is a system dishonest to the fair trader, dishonest to the fair employer. If the evil continues to exist as it has existed in the past, the Legislature must take measures to cut out the canker. It is unnecessary to point out how the evil works to the detriment of the honest trader, who is above such nefarious practices." It is to be feared that nothing short of making the offer and request, the payment and receipt of illicit commissions, penal offences will avail to extirpate the evil from trade.

PERSONAL.

Mr. J. O. Pask, who has been the Manager of the Bungay Gas-Works for the past ten years, is resigning that position. A local paper, in making this announcement, adds that Mr. Pask has, "by his good practical knowledge and close and careful attention to his duties, secured the confidence and goodwill of all with whom he has come in contact; and the news of his leaving will be received with regret."

WATER AND SANITARY AFFAIRS.

The Metropolitan Counties Water Board Bill was read a third time in the House of Lords last week, and after some discussion was passed. At present the chief question concerning the Bill is whether it will get through the Commons so as to become law this year. The prospect is certainly a faint one. The Earl of Rosebery, on the third reading, asked whether "it was really intended" to proceed with the Bill in the other House of Parliament. Lord James of Hereford replied that it would be proceeded with, "unless it was opposed." We apprehend that opposition is exceedingly likely to arise; the Progressives of the County Council believing that the Bill was prepared in order to supersede the Council in the treatment of the Metropolitan Water Question. Lord James has done his best to conciliate opposition, and has framed his Bill "with the object of meeting the views of all parties interested." Hence he entertains a hope that the measure will be allowed to pass without opposition. Such a result, so far as we can see, is very doubtful. Yet, should the Bill fail in the present session, there is a fair chance that, if brought in early next year, it will be carried. As the case stands, the Bill appears with an amendment which even recommends it to the favour of the County Council; that body being empowered to promote legislation dealing with the water supply of its county apart from any action that may be taken by the Water Board. The amendment, we may observe, is one by which the very existence of the Water Board seems to be threatened.

After a series of sittings occupying as many as twenty-seven days, the Hybrid Committee of the House of Commons presided over by Sir Joseph Pease closed their inquiry last Tuesday; the final act being that of rejecting the Southwark and Vauxhall Bill. Wearied with their protracted labours, the Committee may have been glad to come to a conclusion in any tolerable kind of way; yet we must believe that they considered it their duty to declare that the preamble of the Southwark and Vauxhall Bill was not proved. According to the terms in which the Chairman announced this decision, it would seem that the Committee were of opinion that the Company could wait another year without detriment to the public service. Under an Act passed in 1894, the Company are now constructing two reservoirs which when completed will hold 300 million gallons. It was thought at one time that this extension would give the Company sufficient water up to 1902 or 1903. But the Chairman of the Company, Sir H. E. Knight, told the Committee that this expectation had proved a mistake, and the more correct date would be somewhat earlier. On this Sir J. Pease remarked that the Committee could not lose sight of the fact that the Company had 300 million gallons of reservoir capacity which had never been put into action. The inference was also drawn from the evidence of Sir H. E. Knight that an increase of 200 million gallons would suffice until 1901. This is a close date, considering how long it takes to construct water-works of any magnitude. The Company proposed sufficient storage to last until 1911. But their Bill included other matters besides that of storage; and there is also the awkward fact that the Company are already drawing from the Thames all that is warranted by their agreement with the Conservators. In fact, according to the report by General Scott, the Company drew from the Thames in April last more than 31 million gallons per day, whereas they were only authorized to take 24½ million gallons. A parliamentary return moved for by Mr. J. Stuart shows that in June, 1895, the quantity drawn from the Thames by this Company considerably exceeded 36 million gallons daily. The Company have now been asking for a storage three times as great as they proposed in 1894. Parliament may therefore expect to hear of the Southwark and Vauxhall Company next year. Extra expense will thus be put on the Company, constituting a certain tax on the shareholder, though it may not at once fall on the consumer.

Before entering on the Southwark and Vauxhall Bill, the Committee had completed their consideration of the clauses of the Bill promoted by the New River Company, which was then ordered to be reported to the House for third reading. The whole of the five Bills referred to the Committee are thus disposed of; the four that were passed, with amendments, being the Lambeth, Chelsea, Staines

Reservoirs, and New River Bills. A substantial addition to the water supply of the Metropolis thus awaits the final decision of Parliament. But considerations of a yet wider import arise out of the special report presented by the Committee in reference to these measures. The report really goes beyond the limit of the Bills, and deals with the whole question of the Metropolitan Water Supply, in doing which it gives forth a distinctly prophetic sound. It looks forward over a range of "at least thirteen or fourteen "years from the present time," during which period the population of London must be supplied with water from sources "now available." "No large new source" of supply can be introduced in less time than that. To this issue, the Committee say, the evidence laid before them "clearly points." But there is a very significant intimation that, while the sources of supply will continue unchanged for many years, reasons can be found why there should be a very speedy alteration in the system by which the supply is governed. The entire report may, in fact, be looked upon as a kind of preamble to the Metropolitan Counties Water Board Bill. The Committee point out, "with great deference," that the present position of the London Water Supply "is not in accord- "ance with the public interest." Conditions are imposed by Parliament in regard to the issue of new capital by the London Water Companies, under which the public are steadily acquiring an interest "which tends to "weaken the enterprise of the Companies as private con- "cerns;" while on the other hand the consumer is said to be left "without that care of his interests which is ensured "by placing the supply under a representative body in "whose election he is personally interested"—a phrase which might be held to favour the County Council. The present position is declared to be "anomalous," and one of such a nature that it "would be greatly to the public "interest" for both the Water Companies and the inhabitants of London to be speedily freed from it. No blame is cast upon the Companies, except it be that, in bringing applications before Parliament, they usually act without concert with each other, and sometimes produce inconsistent plans. Opposition is offered by local authorities and private persons; and these proceedings are described as "annually costing a very large sum of money," which is exactly what we hear at the half-yearly meetings of the Companies. It is also a fact that these projects have to be considered separately, without reference to any general scheme; and a very perplexing problem is presented to Committees of Parliament. Besides, the rapid increase of the population intensifies the whole question. This special report thus reads very like the beginning of the end of the present state of things.

In the County Council, the report on the Welsh scheme and the question of purchasing the undertakings of the London Water Companies was again postponed last Tuesday; the time and energies of the Council being largely absorbed in the dispute concerning the Chief Officer of the Fire Brigade. As the Council contemplate rising for the summer recess a fortnight hence, there must either be more of a "common-sense pace," or arrears will be left, seeing that several very important questions await decision. The *agenda* bristles with adjourned reports.

Tunnel for the Chicago (Ill.) Water-Works.—We learn from the "Engineering Record" that the last brick in the new 7-feet tunnel of the Chicago Water-Works was laid on the 2nd ult. It extends under Lake Michigan from the Government pier to the two-mile crib, and is 6045 feet long. A tunnel one mile long, built in 1890, connects the Government pier with the Chicago Avenue pumping-station. The engineering was done by the City Engineer (Mr. L. B. Jackson) and his assistant, Mr. C. F. Anderson.

Presentation to Mr. H. M. Thornton.—A pleasing incident of the annual excursion of the employees of Messrs. Richmond and Co., Limited, which took place on Saturday, the 4th inst. (the place selected being Blackpool), was the presentation by the Directors and officials to one of the travellers—Mr. Horace Moore Thornton—who is leaving the Company's service, of a gold hunter watch, as a token of esteem. Mr. Richmond was unable, owing to illness, to be present; but he sent a kindly-worded letter testifying his appreciation of Mr. Thornton's worth to the Company. Mrs. Richmond made the presentation in graceful terms; and at the same time acknowledged the gift to her of a bracelet. Mr. Thornton expressed his sincere thanks for the watch, which would, he said, be a memento of the many kindnesses he had received from the firm, more especially from the Chairman and Managing Director (Mr. Richmond).

ESSAYS, COMMENTARIES, AND REVIEWS.

GAS AND WATER COMPANIES IN THE STOCK MARKET.

(For Stock and Share List, see p. 91.)

THE Stock Exchange had a dull and quiet time last week. What with the hot weather indisposing people Citywards, and the strong attractions of sport towards Henley and the cricket-fields, the daily attendance was small; and the markets were rather weak and inanimate. Such moving influences as were at work were somewhat disquieting. The apprehension of trouble in connection with labour depressed our rails; and the curious proceedings at Chicago did not tend to enliven the American market. Doings in connection with prominent South African undertakings did not inspire confidence; and so generally prices all round come out decidedly worse at the close. The condition of the Money Market is quite unchanged—one might almost say unchangeable. Business in the Gas Market, although rather quiet at first, developed more activity as the week proceeded. Pronounced strength throughout the list was the characteristic; and several of the quotations, including those of the leading issues, effected considerable improvement. In Gaslights, the "A" stock, after a period of quiescence in the earlier part of the week, came into brisk demand, and marked at the close 318—the best price. The secured issues also were strong—the "H" 7 per cent. limited having a smart rise; while the 10 per cents. fetched a level 300. Very little was done in South Metropolitans; but all three issues were advanced by the successful passage of the Company's Bill, whereby they will be amalgamated and converted into one big 4 per cent. issue. Commercial were quite untouched. One or two deals saved the Suburban and Provincial group from absolute stagnation; British being conspicuous by a further advance. The Continental Companies were comparatively active, and in very good form. Imperial pushed up a couple of points more, and Union preference three; the others commanding high figures. Among the minor undertakings, the Argentines were again noticeable for buoyancy. Transactions in Water were very limited; and movements were irregular. In Chelsea, Kent, New River, Southwark, and West Middlesex, some very fair advances were made; but, on the other hand, Grand Junction receded considerably, and East London to a less extent.

The daily operations were: Business in Gas was scarcely up to the average on the opening day; but the gene tendency was very good. Gaslight "H" rose 3. East London Water fell 1. Tuesday was not more active, but was equally firm. Continental Union preference advanced 3; and Buenos Ayres, ½. In Water, Southwark preference and West Middlesex rose 2 each. Business was at about the same pressure on Wednesday—everything commanding good prices; but the only change in quotation was a rise of ½ in British. Thursday produced greater activity, mostly in Gaslight issues. South Metropolitan "A" advanced 5; ditto "B," 2; and ditto "C," 1. In Water, Kent new rose 3; Chelsea, 2; West Middlesex, 1. Dealings on Friday were mainly in Gaslight "A." Imperial Continental moved up 2; and Belgrano, ½. In Water, West Middlesex rose 2; but Grand Junction fell 2½. Saturday was quiet, but strong. Gas remained unaltered; but in Water, New River gained 2.

ELECTRIC LIGHTING MEMORANDA.

Proposed Electric Tramway for Glasgow—The Trolley-Wire Paramount—Cost of the Experiment—Where is the Gas-Power Tramcar?

AN important report on electric traction for tramways has been prepared by a Sub-Committee of the Tramways Committee of the Glasgow Corporation, which seems, judging from the newspaper abstract that has been published locally, to present in a very instructive and convincing way the facts relating to this matter. To begin with, the Sub-Committee entered upon their inquiry with no hampering illusions as to the expediency of combining the working of tramways with an electric lighting system. They know all about municipal electric lighting in Glasgow; and they are consequently not so likely as less experienced people to be carried away by sanguine promises of the advantages hypothetically derivable from making one kind of electrical venture bolster up another. The report starts from the safe datum of horse-traction tramway results, as realized in Glasgow. The Sub-Committee admit that, while these results are satisfactory up to a point, it would be an improvement if a perfectly flexible system of traction for tramways could be introduced, which, while being equally cheap and safe, and under as good control, would admit of increasing the speed where this could be done in the quieter thoroughfares; thus providing a more rapid suburban service. This observation undoubtedly touches the weak spot of horse tramway working, which, as a matter of fact, is too slow for anything like long distances as measured even by the omnibus standard, to say nothing of railway service.

As regards cost and public convenience, it is considered that it would be preferable if the improved system of traction could be introduced without serious interference with the foundation

of the existing tramways. Electric traction promises to fulfil these conditions, and the Sub-Committee confess that, all other things being equal, a system of the kind which would provide power without overhead constructions would be preferable. But they are constrained to admit that, whatever the future may have in store in the way of underground conduit systems, at present nothing of the kind is in more than the experimental stage. On the score of expense, and for other reasons, there is actually nothing for it in the way of electric tramway working except an overhead system. This is found to be the simplest, the cheapest to construct and work, the most accessible for maintenance and repairs, and, on the whole, the most efficient system of mechanical traction which has been subjected to the test of actual working. Moreover, the principal part of the plant required for working a trolley-wire system would still be available in the event of the evolution of a desirable conduit system, the removal of the overhead wires at any time being a matter of no great moment.

With regard to the debated question of the appearance and safety of the overhead trolley-wire, the Sub-Committee consider that, if constructed on the most improved principles, the overhead lines are not seriously offensive to the eyes; a short acquaintance sufficing to remove preconceived objections to them on this score. And as to safety, the main source of danger seems to have been primitive and careless erection and insufficient care of the wires. It is also considered that the overhead wire is quite compatible with top seats on the cars; and that, having regard to all the circumstances, the only choice left for Glasgow is either to test the overhead system of traction on one of the city lines, or decide to abide by horse traction for a time, and watch developments. This is the strongest position that could be taken up in regard to the whole question. If the report is adopted in its entirety, a trial will be made on the route from Kelvinside to Dennistoun—a length of 4¼ miles of double track. To equip this line with electric power plant would cost about £54,000; and the additions to and alterations of the track would cost another £15,314. This is a serious amount, doubtless; but it dispenses with horses, is expected to result in an economy in working, and will give a quick service at two-minute intervals, which should go a long way towards popularizing the route. The experiment is worth trying; but meanwhile, where are the gas-power tramcars? If gas power does not have at least a "show" in connection with this important Glasgow tramway improvement, may it not be interpreted as a confession of failure? Yet the successful starting of the gas-motor cars on the new line from Blackpool to Lytham last Saturday, of which an account appears elsewhere, ought to supply a negative answer.

According to the latest American testimony, however, the contrary conclusion is correct. Writing in the "Engineering Review," on Electricity and the Horseless Carriage problem, Mr. W. Baxter remarks that "many attempts were made to solve the street-car problem by the use of steam, but all failed, notwithstanding that some of the best engineering talent of the day grappled with the subject. Gas and oil engines also have been tried in this field; but their success was no greater—in fact, not so great. When electricity came into the field and achieved a complete success, the advocates of gas and oil engines put forth their greatest efforts, in the hope that the excitement of the moment, caused by the overwhelming victory of the trolley-car, might enable them to get at least a slight foothold. But their failure was absolute; and, so far as the street-railway field is concerned, oil and gas engines have sunk into oblivion." Perhaps the value of Mr. Baxter's evidence on this head may suffer from the fact that he yet believes that something may be done in the way of traction by storage batteries. It is true, as he admits, that there are no such batteries actually in the market as would answer the purpose; but he regards them as possibilities, if not exactly probabilities, of the future. It is at any rate to the credit of the Glasgow Tramways Committee that they live in the present, and confine their attention to practical issues.

Nitrates in Potable Waters.—This subject was treated by Herr Schlœsing in a recent number of the "Comptes Rendus." In the author's opinion, as a first test for distinguishing drainage from springs, it is sufficient to determine nitric acid and lime. He accordingly gives a tabular view of the quantities of these two constituents expressed in milligrammes per litre. His determinations of nitric acid are made in 4 litres of water evaporated down to a few cubic centimetres. When operating upon the water of the Avre, he has always been able to complete this concentration in one and the same 2-litre flask. The precipitate is always more or less yellow, like the dry extract containing the nitrates. The water of the Dhuis is most commonly in the same state as that of the Avre; but the precipitate is of a lighter colour, and the dry extract is less yellow. Sometimes it became impossible to evaporate the 4 litres in one flask on account of the violent bumping due to the calcareous deposit, which in such cases was of a pure white, while the extract was nearly colourless. In such cases, the author divided the water in halves, and boiled them in two flasks until the carbonate was entirely precipitated. He allowed the residues to settle, and evaporated the clear decanted liquids in a third flask.

DR. HALDANE ON CARBON MONOXIDE POISONING.

In the course of his interesting lecture to The Gas Institute on the characteristics and detection of explosive gaseous mixtures, Professor Frank Clowes made appreciative reference to the labours of Dr. John Haldane, Lecturer in Physiology, of the University of Oxford, upon an important branch of this subject. A Blue-book lately issued contains Dr. Haldane's report on "The Causes of Death in Colliery Explosions and Underground Fires, with Special Reference to the Explosions at Tylerstown, Brancepeth, and Micklefield," which may be commended to those who desire to become more fully acquainted with the nature of the work now being done in the interests of humanity by this devoted investigator. Death from the explosion of colliery gases and underground fires shares with many other of the ills to which industrial mankind is heir, the peculiarity of being attributable to more recondite and complex causes than were at one time thought of in connection with such casualties. For a long period in the history of coal mining and other industrial operations involving the handling of coal in bulk, deaths from explosions of gas evolved from the raw material were regarded in the light of incidents of the traffic as simple as they were deplorable. The adoption wherever possible, and where risk from gas was to be feared, of a few plain precautions, was consequently considered to be competent to prevent disaster; and it was not until some apparently mysterious accidents had occurred to disturb the self-sufficiency of practical science in this regard, that deeper inquiry into the causes of such catastrophes was found to be necessary. Thus it was only after coal had been mined in this country for nearly a century that it was borne in upon observers of colliery explosions that coal dust alone, or in conjunction with inflammable gas, was competent, under certain conditions, to produce explosions; and now a considerable literature has been formed with reference to this branch of the subject. It was soon discovered, moreover, that the admission of coal dust to the character of an explosive opened up a long vista of consequential investigation, and entailed, among other things, a thorough reconsideration of the characters of coal gas and dust explosions and their effects. The services of physiological science were called into requisition for this purpose, to supplement the work of chemists and mechanical engineers; and in the person of Dr. Haldane an investigator was happily found who has abundantly justified this enlargement of the usual range of explosion inquests.

The report now made public relates to a series of typical coal-mine explosions and fires. The Tylorstown case, which belonged to the South Wales coal-field, happened on Jan. 27 last, and was an explosion propagated through three pits by coal dust, when 57 men and 30 horses were killed. With the exception of the victims of physical violence, all those who died from the after-damp exhibited in their bodies a bright red, lifelike complexion, especially in the palms of their hands. Tests of the blood drawn from these bodies were made by the colorimetric method devised by Dr. Haldane, and briefly described by Dr. Clowes in his lecture, and showed that the hæmoglobin was 79 per cent. saturated with carbon monoxide. This was the first time that the percentage saturation of the blood at the moment of death from carbon monoxide poisoning had been shown. Hence it was concluded that death in these and similar cases was due to this cause, and not to suffocation. All the horses examined were killed by the same agency. The rescue parties found many men lying dead with their lamps still burning beside them. Some of the rescuers experienced the effects of the carbon monoxide laden atmosphere in the pits; the first definite symptom being loss of power over the legs—the men sinking helpless to the ground with very little previous warning. None of the poisonous atmosphere remained to be analyzed; but Dr. Haldane explains its probable composition. He lays stress upon the remarkable tendency of fire-damp, emanating naturally from coal, to accumulate in high places without mixing with the fresh air below.

Dr. Haldane observes that the physical and chemical conditions which prevail along the track of an explosion as it sweeps the roads of a pit, are by no means clear. "It seems probable, however, that there is not a complete combustion of the particles of coal dust, and that what burns in the explosion is gas distilled off by these particles." After an explosion objects are found encrusted with melted, or partially coked, coal-dust. "The half melted particles of dust have evidently lost part of the gas which they yield on dry distillation; and doubtless this gas feeds the flame." This observation is a testimony to the quickness with which coal dust may be carbonized; the first gas to come off being chiefly methane. The partial combustion of this gas, however, would hardly produce much carbon monoxide, such as did the mischief at Tylorstown. Dr. Haldane refers to an analysis by Smithells of the products of combustion of methane and common coal gas respectively in an insufficient supply of oxygen, which showed that with the former not more than 4½ per cent. of carbon monoxide was found in the residual products (after-damp); while with the coal gas the proportion might rise to 10 per cent. The gas burnt in a dust explosion probably, he thinks resembles fire-damp more nearly than coal gas; but may be capable of giving more carbon monoxide than the former. He

considers that the after-damp does not contain, on the average, more than 3 per cent. of carbon monoxide.

In discussing the effects of different gaseous products of combustion upon men and animals, Dr. Haldane returns to the consideration of carbon monoxide, which is stated to be "present in after-damp, smoke, and 'gobstink'—*i.e.*, the mixture of gases given off from coal which was spontaneously heated. It differs from other poisonous gases in its particularly slow and insidious action." The reason for this is given at some length, and refers to the powerful affinity of carbon monoxide for the hæmoglobin of the blood, which operates when there is only a very small percentage of this gas in the atmosphere. From this fact arise some important practical points. "The hæmoglobin of blood brought into contact with air containing about 0·1 per cent. of carbon monoxide will finally become about equally saturated with carbon monoxide and oxygen. If the same blood be afterwards brought into contact with pure air, constantly renewed, the carbon monoxide is gradually driven out. This process of driving out occurs about five times as fast in pure oxygen. . . . When the blood of the living body has become about 50 per cent. saturated with carbon monoxide, there is loss of power over the legs." The time required for the production of this latter effect of course depends on the production of carbon monoxide in the air. "In any case, where it is necessary to work in an atmosphere suspected of carbon monoxide, men should, so far as is possible, be kept in reserve in fresh air." The attention of gas managers having to deal with cases of the spontaneous combustion of coals in store may be directed to this precaution, as well as to the following passages of the report:—

> The danger of advancing far along passages containing after-damp, smoke, gobstink, &c., is very evident, since a man may go a long way before he feels the effects of the carbon monoxide, and when he does feel them, he may be quite unable to escape. . . . Hence the importance of paying attention to the first symptoms which precede the stage of complete helplessness, although these may easily be unnoticed, or made light of in the excitement of a rescue. . . . The first and most important signs of the accumulation of carbonic oxide in the blood are dizziness, weakness in the legs, dimness of sight, and palpitation following any extra exertion, such as lifting a heavy weight, ascending a steep incline or running. These symptoms become quite distinct when the blood is about 25 to 30 per cent. saturated. As the saturation increases, the symptoms become more and more marked, until finally, at about 50 per cent. saturation, the limbs are so weak that any effort to walk causes them to give way entirely.

Very little distress accompanies the toxic action of carbon monoxide; death supervening upon a stage of numbness and insensibility. Recovery is painful, and is very gradual in severe cases. Sometimes men affected in this way appear to get worse on removal into fresh air. If administered promptly, however, oxygen is of service in rapidly clearing the blood of the poison. Heat is also of much importance.

For detecting the presence of carbon monoxide in air, Dr. Haldane advises the explorer to carry in a cage a white mouse, which will exhibit in a few minutes the symptoms that will affect a man from twenty minutes to half an hour later—thus giving ample warning. "When dangerous percentages of carbon monoxide are encountered, the mouse will begin to pant, and show signs of weakness in the legs. Should the mouse suddenly become unconscious, danger is imminent." This is the modern scientific variant of the old fable of the lion and the mouse.

Dr. Haldane describes the appearances presented by a mouse sacrificed in the cause of science by being plunged into an atmosphere of coal gas. Although the coal gas contained about 5 per cent. of carbon monoxide, and no oxygen, the blood in the veins and most of the organs became only very partially saturated with the former, which Dr. Haldane accepts as the explanation of the extraordinarily rapid recoveries sometimes observed in cases of acute poisoning by coal gas. As soon as the coal gas is removed from the lungs, and a plentiful supply of oxygen or air substituted for it, the unsaturated venous blood still slowly entering the lungs takes up oxygen abundantly, and causes rapid recovery as soon as it reaches the tissues.

Consideration of this observation leads to a remarkable conclusion. Except in two cases, none of the victims of the after-damp of the Tylorstown explosion showed the appearances described; whence it follows that "oxygen sufficient to support life must have been left in the air-ways all along the track of the explosion." This discovery came to Dr. Haldane as an entire surprise. He had previously thought that, as carbon monoxide was present in the after-damp, all the oxygen in the air must certainly have been used up, and that men in the track of the explosion must be killed by the absence of oxygen, if not by other causes. Yet there were other evidences, as fires of coal and timber, to show that at least 80 per cent. of pure air remained after the explosion. The effect of this would be to dilute the carbon monoxide, only to render its poisonous action more thorough. The weaker the carbon monoxide, so long as it is present in deadly quantity, the more complete the saturation of the blood exposed to its action. The fatal result is, of course, always the same; but the after-appearances differ. His experiments with mice convinced Dr. Haldane that there must have been less than 2 per cent. of carbon monoxide in the air which killed the men and horses at Tylorstown. Assuming that from 1 to 1½ per cent. was the proportion, this would mean death to human beings confined in such an atmosphere in from 40 minutes to an hour. Loss of consciousness would occur much earlier, probably within from eight to twelve minutes. These times, therefore, indicate the margin left for escape or rescue from such an atmosphere. The excess of carbonic acid or the deficiency of oxygen in the same atmosphere would not have any noticeable results.

With regard to the heat-effects of a gas or coal dust explosion, as exhibited in burns, Dr. Haldane exercises much reserve. He thinks the heat of combustion of the explosive mixture must be very quickly taken up by the cloud of coal dust raised but not carbonized, which has about 1000 times the specific heat of air. Moreover, the same dust would absorb a large proportion of the volatile or gaseous distillation products. Again, "the loosening of the epidermis observed in cases of burning (by a gas explosion) is probably caused by the sudden liberation of gas or aqueous vapour between the layers of the epidermis through the temporary action of a blast of exceedingly hot gas. It would seem that this loosening of the epidermis need not imply serious injury." Finally, it is not in connection with the working of coal mines only, when troubles arise through explosion, gassing, and so forth, whether on a large or a small scale, that "nearly everything that can be recommended must depend for its success on previous preparation and organization." This is one of the greatest of the lessons that prudence can extract from such sad records as those passed in review by Dr. Haldane.

The Electric Light in Lighthouses.—The employment of electricity in lighthouses is still being much discussed in connection with the loss of the *Drummond Castle*, already referred to. In the course of a letter to "The Times," Mr. J. R. Wigham has again raised the question of the suitability of the electric light for furnishing the mariner with a reliable beacon; and it has been suggested that the recent disaster would not have occurred had oil been employed in the Ushant lighthouse. The fact that sailors know that a certain point is powerfully lighted by electricity inspires confidence which is sometimes a source of danger owing to the want of penetrating power in the light in times of fog or mist. This is borne out by an incident cited by Mr. Maciver in a recent letter to "The Times." Some years ago, he was on a voyage from Portsmouth to Havre. As he neared the French coast, the weather became hazy, and when well within the range of the two powerful electric lights of Cape de la Hève, and seeing nothing of them, he considered it prudent to slow down and take a cast of the lead. The soundings obtained coincided with those shown in the chart for what he assumed to be the ship's position—namely, quite close to the land, with Cape de la Hève slightly on the port bow. As no lights were visible, and having proceeded as far as he considered it prudent, he anchored, and waited for daylight or clearer weather. About two hours afterwards, the haze began to clear away; and then, for the first time, the splendid electric lights, almost blinding in their brilliancy, became visible quite close to him. This shows how risky it is to trust to seeing a light in time to avoid getting into danger. In view of these facts, the attention of the Government is being again called to the advantages of gas as a lighthouse illuminant.

British Association of Water-Works Engineers.—The first annual general meeting of this Association will be held at Nottingham next week, under the presidency of Mr. D. M. F. Gaskin, M.Inst.C.E., the Water Engineer of the Nottingham Corporation. The programme extends from the Monday evening (when there will be a reception of the members by the Mayor, Alderman Bright) to the following Friday; but the time allowed to actual business is rather short—covering only Tuesday and the following morning. The *agenda* includes general business, the President's address, and ten papers. Professor Clowes will enlighten the members on "The Interpretation of Results of the Chemical Examination of Water;" Mr. C. E. De Rance will discourse on "Hydrogeology and Hygiene;" Mr. J. A. Paskin, of Halifax, will deal with the subject of "Discharge Tunnels for Reservoirs, with Valves fixed Therein;" Mr. R. E. W. Berrington, of Wolverhampton, will direct attention to "The Use and Misuse of Water;" Mr. Percy Griffith, of London, will give some information as to the "Halstead Water-Works Extensions;" Mr. O. J. Kirby, of Batley, will treat upon the "Waste of Water in its Relation to Lead Service-Pipes;" Mr. W. Watts, of Oldham, will present some "Notes on Sinking and Timbering of Concrete and Puddle Trenches for Reservoir Embankments;" Mr. T. Molyneux, of Stockport, will give a description of "New Water-Works at Dilmston;" Mr. J. Shaw, of Boston, Lincs., will describe "Some Causes of Failure in Service Mains and Pipes;" and Mr. A. Dick, of London, will have something to say as to the "Properties and Use of Delta Metal in Connection with Water-Works." On Wednesday afternoon the water pumping-stations of the Nottingham Corporation at Basford, Bestwood, and Papplewick will be visited by the members; and the annual dinner will be held in the evening. Arrangements have been made for excursions on the following two days; among other places to be visited being the Stanton Iron-Works and the "Dukeries."

NOTES.

Sulphate of Ammonia as a Land Dressing.

The annual report just published by the Kent Technical Education Committee deals with a number of experiments made at the Kent Horticultural College, and gives some particulars as to the effect of dressing the land with sulphate of ammonia in various cases. In the experiments with raspberries, Professor Luckhurst's mixture, made up of nitrate of soda, muriate of potash, sulphate of ammonia, and steam bone flour in equal parts to the extent of one-half, and the other half mineral super-phosphate, yield per acre 22 cwt. 31 lbs. to a dressing of about 1½ cwt. All the canes throve well, the foliage was healthy, and the fruit good. In the trials with potatoes, a number of artificial mixtures were used with the annexed results:—

Dressing.	Yield Per Acre. Tons.	cwt.	lbs.
1.—Unmanured	6	1	20
2.—Sulphate of ammonia, 2 cwt.; superphosphate, 3 cwt.	7	2	48
3.—Sulphate of ammonia 2 cwt., sulphate of potash super 3 cwt.	8	16	48
4.—Same, but with 2 cwt. of sulphate of potash	9	12	76
5.—Same " 3 cwt. " "	10	5	76
6.—Sulphate of ammonia 2 cwt., super 3 cwt.; kain it, 4 cwt.	11	3	73
7.—Duplicate of plot 5	12	19	0
8.—Duplicate of plot6	12	5	68
9.—Manchester manure	11	16	36
10.—Professor Luckhurst's mixture, 10 cwt.	12	11	20
11.—Basic slag, 6 cwt.; nitrate of soda, 2½ cwt.	10	19	68
12.—Same, with 3 cwt. of sulphate of potash	12	5	21
13.—Basic slag, 6 cwt.; kainit, 4 cwt.; nitrate of soda, 2½ cwt.	10	19	15
14.—Duplicate of plot 10	13	11	68
15.—Duplicate of plot 11	10	3	36
16.—Duplicate of plot 9	14	11	12
17.—Duplicate of plot 12	11	6	68
18.—Unmanured	12	12	13

The variety of potato used was the Imperator; and the quality of the potatoes was all very good. The Committee state that it is a question whether the increments which follow the increased dressings of potash are really due to that cause, or simply to differences in the fertility of the soil; but past experience, and the regularity of the increments on plots 2, 3, 4, 5, and 6 encourage the former view—in fact, the fertility irregularities seem to occur in the other portion of the land, including plots 7 to 18. The successive and additional increments per hundredweight of potash are then 34 cwt., 16¼ cwt., 13 cwt., and 18 cwt. for the first, second, third, and fourth hundredweight respectively; but not alone is this increase in weight evinced. There is also an improvement in quality; and taking the plots in the same order, there is respectively, 69, 73, 75, and 80 per cent. of ware as compared with 31 per cent. on the unmanured land, and 56 per cent. with all the manures except potash. The Committee consider the experiments ought to be continued.

The Improvement of Incandescent Lamp Filaments.

Attempts to utilize the superior incandescing quality of the "rare earths" for the improvement of the incandescent electric lamp, continue to be noted at intervals in the electrical journals; but very little is afterwards heard of them. Nevertheless it is remarkable that a property of certain substances which renders such good services in connection with gas lighting should remain intractable in a similar direction. The latest effort for the improvement of the filament of electric lamps in this way starts with a foundation of hydroscopic asbestos paste, which is first made into sheets one-third of a millimetre thick, and is then cut into strips 6 centimetres wide, and impregnated with a 30 per cent. solution of platinum chloride. It is then passed through a saturated solution of sal-ammoniac, dried in hot air, and fired in a bunsen flame, which converts the platinum into sponge. This is then further impregnated with a 20 per cent. solution of magnesium chloride, and heated; the process being repeated until the plate is covered with a uniform coating of magnesia. It is finally dipped into a 10 per cent. solution of "cerite nitrate." The idea is that the magnesium coating protects the platinum, while the superior incandescing quality of the cerite metals are to be developed on the outside of the filament, with the object of getting more light from the current used than is possible with carbon.

Recent Progress in Optics.

Professor W. Leconte Stevens has been discoursing upon recent progress in optics. He remarked that, from the physical standpoint, optics includes those phenomena which are presented by either vibrations within such narrow limits of wave-length as can affect the sense of sight. But these waves can scarcely be studied except in connection with those of shorter or of longer period. Whatever may be the instruments employed, the last one of the series through which information is conveyed to the brain is the eye. The physicist may fall into error by faulty use of his mathematics; but faulty use of the senses is a danger at least equally frequent. Professor Stevens went on to describe the method devised by Michelson for using light-waves as the foundation of measures of length. The red ray of cadmium was found to be the simplest for the purpose, and, working with M. Benoît, the Director of the International Bureau of Weights and Measures, Michelson was enabled, after many months of labour, to obtain results of extraordinary accuracy. As a mean of two independent determinations, the metre was found to be equal to 1,553,163·5 wave-lengths of the red line of cadmium. Professor Stevens discussed the phenomena of luminescence, without finding that much progress has been made in the understanding of the phenomena; but he mentioned that his colleague, Professor Mayer, has devised a disc photometer based on colour contrast, with which the error of a single reading is found to be much less than with the Bunsen photometer. The rotating colour disc has been applied by O. N. Rood to the determination of luminosity independent of colour, by taking advantage of the flickering appearance on a rotating disc upon which two parts have different reflecting powers. Reference has been already made in the "JOURNAL" to the work of this investigator. At a certain critical speed, the effect of observing the disc varies with the intensity of the incident light.

Lighting by Vacuum Tubes.

Mr. D. MacFarlane Moore has delivered a lecture before the American Institute of Electrical Engineers describing the advances he has made in the development for practical purposes of lighting by vacuum tubes; claiming not merely the possibility, but also the near probability, of the introduction of a system of lighting upon this principle that shall rival sunshine and possess the same qualities. Prominent among these is to be the property of complete diffusion of light in all directions, to the almost complete elimination of shadows. This result, according to Mr. Moore, is to be attained by the utilization upon a commercial scale of the potentialities of the Geissler tube, familiar as a scientific toy in the hands of popular lecturers on electricity. When a suitable electric current is connected with the terminals of such a tube, it is filled throughout its entire length with a faint glow of light, which is of a totally different character from any light now used commercially. It is light emanating from rarefied air, with an apparent absence of heat and combustion. The duty of the vacuum tube is very high, as it transforms 70 per cent. of its supply of electrical energy into light; but hitherto the difficulty of making it sufficiently bright to serve any practical purpose has proved insurmountable. Moreover, the difficulty of insulating the current employed in producing this phenomenon is very great; and it is necessary to enormously expedite the make-and-break arrangement for giving the spark, if the luminosity of the glow is to be increased. Mr. Moore claims to have overcome those obstacles to the successful production of an illuminating Geissler tube; and the lecture hall was lighted by such tubes extending round the room. This was the first time that lighting by tubes had been attempted on so large a scale; and the effect is reported to have been very pleasant. There still remains, however, the question of the cost of producing and manipulating energy in this particular form, as to which no information is as yet forthcoming.

A New Method of Distinguishing Coal-Tar Benzene from Petroleum Benzine.—The "Chemiker Zeitung" states that Herr A. Lainer has discovered a new and certain method of distinguishing coal-tar benzene, or benzol, from petroleum benzine, or benzoline. He formerly proposed to add to the liquid a small crystal of iodine, which gave a carmine red colour to the coal-tar product, and a violet colour to the petroleum product. He now finds that coal-tar benzene, on agitation with a few drops of alcohol, becomes much clouded; while benzoline remains clear. Toluene and xylene resemble coal-tar benzene in their behaviour with traces of alcohol.

Madame Alting-Mees on the Advantages of Cooking by Gas.—Madame Alting-Mees has an established reputation as a lecturer on cookery; and her value to gas companies as an exponent of the advantages of their commodity as the fuel to be employed in culinary operations, has been frequently pointed out in the "JOURNAL." On the Continent, her services have been in much requisition, on account of her fluency in French; and she has been admitted an associate member of the Société Technique. Her success abroad has called for a new edition of her pamphlet entitled "La Cuisine au Gaz: Ses Applications, ses Avantages, et son Economie," which has lately been issued with an additional chapter on other domestic uses of gas.

North British Association of Gas Managers.—We have received from the Secretary of this Association (Mr. R. S. Carlow, of Arbroath) the programme of the thirty-fifth annual meeting, which is fixed for the 22nd and 23rd inst., in the Victoria Hall, Waterloo Hotel, Edinburgh. Mr. A. Yuill, of Alloa, will preside. In addition to the President's address, there will be five papers: "Forfar Retort-House Plant," by Mr. Forbes Waddell, of Forfar; "On the Permanency of Illuminating Gas," by Mr. W. Young, of Peebles; "Notes on London Gas Supply," by Mr. J. M'Gilchrist, of Dumbarton; "On Labour-Saving Methods in Photometrical Testing," by Mr. Henry O'Connor, Assoc.M.Inst.C.E., of Edinburgh; and "On Back-Pressure," by Mr. J. Ballantyne, of Rothesay. All these papers will furnish good topics for discussion. After the business, the members and their lady friends will dine together. On the second day of the meeting there will be an excursion by steamer to Stirling; passing through the far-famed "Links of Forth." It may be noted that the meeting will take place a day earlier in the week than usual.

TECHNICAL RECORD.

GAS TRACTION FOR TRAMWAYS.

Adoption of the System on the Blackpool, St. Anne's, and Lytham Line.

Among the Parliamentary Notices which appeared last November was one of the intended application by the Blackpool, St. Anne's, and Lytham Tramway Company, Limited, for a Bill to revive the powers and extend the time for the completion of certain lines of tramway authorized by an Act obtained in 1893, to give the Company running powers over tramways belonging to the Corporation of Blackpool, and to enable them to enter into agreements with the Corporation. The Bill was introduced in due course; and it now only awaits the Royal Assent. In the meantime, the line has been completed as far as St. Anne's; and the second section, to Lytham, is expected to be ready in about a month—the works having been somewhat delayed owing to certain sewerage operations. The matter is of special interest to our readers, from the fact that upon this line of tramway, which is about seven miles in length, gas is to be the motive power; and moreover it will be the first line in England worked entirely in this way. Associated with the above-named Company in this important "pioneer" undertaking are the Gas Traction Company, Limited, of 22, Chancery Lane, London, who have acquired the right of working the Lührig system, which has been successfully adopted on the Continent; and the cars are supplied by them. The line has been constructed in accordance with plans prepared by Mr. Charles Chadwell, of Blackburn, the Engineer to the Tramway Company; and the carrying out of the works has been supervised by his assistant (Mr. G. A. Picken). The section actually finished, and the cars, as well as the general arrangements for working them (which have been carried out by Mr. L. A. Legros, the Engineer to the Gas Traction Company), were inspected last Wednesday by Major Marindin, R.E., on behalf of the Board of Trade, with the result that he gave formal permission for the line to be opened. This was done on Saturday, in the presence of the Chairmen and officials of the two Companies, the Mayor and Town Clerk of Blackpool, representatives of the Local Authorities concerned, and a number of invited guests. Three cars left the South Shore Station at Blackpool shortly before eleven, and ran to the gas-compressing station, which is just off the line at a place called Squire's Gate. There a stop was made to allow of the compressing engine and the process of charging being shown; and then the cars proceeded over the rest of the line to St. Anne's—the whole distance (about four miles) being done, including the stoppage at the station, in forty minutes. For the first mile and a quarter the line is perfectly straight; but then it makes a sharp curve, and runs at a right angle up to the station. A few yards beyond this point it passes over a railway bridge, with a gradient of 1 in 30, makes another sharp curve, and then goes straight for the remainder of the distance. On the occasion of the trial trip with Major Marindin, the car ran steadily, and with perfect smoothness; and the running was equally satisfactory on Saturday.

The Lührig system, with which the Gas Traction Company, Limited, are identified, has already been noticed in the "JOURNAL;" an illustrated description, showing how the motors are fitted to the cars, being given in the number for Dec. 10 last year. The cars are of the ordinary type, with "garden" seats, as in general use in this country. All the machinery is concealed, is cleanly in working, and does not cause annoyance by vibration, heat, or smell. The last point has been successfully accomplished by the introduction of a special lubricating arrangement; while the absence of vibration and noise is due to the gradual improvement effected in the construction of the working parts, by the employment of special air and exhaust silencers, as the result of the inventive genius and engineering ability of Mr. H. P. Holt, of Messrs. Crossley Bros., Limited. The four cars which have been supplied for Blackpool carry 40 passengers—16 inside and 24 outside; but sixteen others are to be built large enough to accommodate 50 passengers. They are 12 feet long in the body, which is 7 feet broad; the entire length over the platforms being 19 feet. The four wheels are 2 ft. 6 in. diameter; and the brake gear is of the maximum possible power. It is of the usual type, modified to suit the general arrangement. The engines, which are of 15-horse power, have two cyclinders, 7¼ inches diameter and 9¾ inch stroke. They will drive a loaded car easily at a speed of eight miles an hour on the level road (they will, in fact, run up to twelve miles), or five miles an hour on steep gradients. They make 80 revolutions a minute when the car is stopping; 260 revolutions when it is running. The gas storage cylinders are 18 inches in diameter and 10 ft. 9 in. long. They are charged by an india-rubber pipe with gas taken from two larger cylinders, 20 feet long and 4 feet wide, located at the compressing station. Into these the gas, drawn from the ordinary service, is compressed by an 8-horse power engine to 11 atmospheres; and it goes into the car cylinders at about 10 atmospheres—supplied to the engines through a reducing-valve. The operation of charging takes about a minute; and sufficient gas is stored to last for a run of eight miles. The car, which with its machinery weighs about 7 tons, as compared with 12 tons formerly, can be driven in either direction; and it is perfectly under the control of the driver by means of a lever working a specially designed friction clutch. Risk of accident from explosion is removed, as there is no light of any kind upon the car itself; the ignition of the gas in the engine being effected by an electric spark.

To the foregoing details a few figures may be added as to cost of working the gas system for tramways. Readers will doubtless remember that gas traction by the Lührig system has been in use for some time in Dresden and Dessau. A very interesting paper on the subject of the installation in the latter town was read by Herr W. von Oechelhaeuser, the General Manager of the German Continental Gas Company, at the meeting of the German Association of Gas and Water Engineers in the past year; and an abstract of it was given in the "JOURNAL" for Aug. 27 last. Professor Kennedy has also reported upon the results obtained in both towns. In Dresden, with a line not quite three miles in length, with easy gradients, the total expenses for gas, including that used in the compressing-engine, in the first six months' working, came, at 2s. 6d. per 1000 cubic feet, to 1·23d. per car-mile. These figures must not, he said, be accepted as showing the best that could be done, as the undertaking was the first of its kind, and moreover they represented the results of working in very bad weather, along a line not specially constructed with a view to mechanical traction, and particularly trying to any form of motor car. Although these results were good, those obtained at Dessau were better, inasmuch as the cost came out at 0·9d. per car-mile. Reporting upon the experiment made on the Croydon and Thornton Heath line two years ago, and noticed in our columns at the time, Mr. Corbet Woodall, M.Inst.C.E., gave the cost at less than 1d. a mile run, as compared with 2½d. for electricity on the trolley-wire system, and 5d. for horse traction. According to some figures furnished to his Company by the Manager of the Dresden Tramways, the cost of horse traction for the past year was 5½d. per mile run, as compared with 4½d. for electricity and 3½d. for gas. The actual consumption of gas on the car is 28 cubic feet per mile; so that, allowing something more for what is used at the compressing station, a tolerably close estimate could be arrived at. Of course, there will be in addition the expenses of maintenance, and wages, &c.; but these must compare favourably with those incidental to a system of horse traction. The initial cost of a gas motor car does not differ materially from that of an ordinary car, with the necessary number of horses.

The question of horseless carriages is just now, thanks to the enterprise of the "Engineer," very much to the front; and the Blackpool people are determined to show they are in the movement by giving gas-engines a trial, and so helping the day consumption from the gas-works of the Corporation. It is to be hoped the quantity required will make a "large order." The result of the first year's working will be awaited with considerable interest. Gas traction has passed beyond the region of experiment. In addition to Dresden and Dessau, the system is in operation in St. Petersburg, on the Charlottenburg line in Berlin, in Stockholm, and in Paris; and it has so much to recommend it in the way of convenience of application, As far as Blackpool is concerned, the line shortly to be completed over its entire length will afford the crowds of visitors who flock there during the season a unique opportunity of enjoying a drive at a cheap rate along the edge of the Fylde coast; and doubtless many thousands of them will annually make the trip. But, judging from what transpired at the lunch at the Clifton Arms Hotel, Lytham, after the opening ceremony on Saturday, this line is only another section of a big scheme for connecting the Ribble with the Wyre by a splendid system of tramways worked electrically or by gas traction. In fact, the Chairman of the Tramway Company (Mr. Alderman Pilling, of Stockport) even goes so far as to cherish the hope that, by bridging the first-named river, his own town may be more closely connected with the sister borough; while Colonel Ellis, in proposing the toast of the day, ventured to predict that gas tramcars would be generally used in England in a few years—a view shared largely by Mr. F. Moulton, Q.C. At all events, they have established themselves at Blackpool. There has been a little "friction" in connection with the undertaking; but, thanks to the tact of the Secretary of the Tramway Company (Mr. E. H. Turner), who has been supported by his Directors, all parties are now united to further each other's interests. The prospects of gas traction in the Fylde district are consequently all the more favourable.

It only remains to acknowledge the liberality displayed by the Directors of the Gas Traction Company, Limited, in the arrangements they made for the comfort of their guests at the opening ceremony. The London party, which included the Chairman of the Company (Mr. R. W. Wallace, Q.C.) and the Secretary (Mr. Percy Holyoake), left Euston on Friday afternoon in special dining saloons attached to the 4.10 train; and these were available for the return journey on Saturday.

A Large Coal Find near Wigan.—The Garswood Coal and Iron Company report a big coal find at their Bryn pits, near Wigan. A shaft had been sunk to a depth of 540 yards, and last week a 4 ft. 6 in. seam of coal was met with. Preparations were at once made to open the bed, which it is expected will take between forty and fifty years to work out.

CYANIDES FROM BYE-PRODUCTS.

At the Meeting of the Gas Engineering Society, held, by permission of the Governors, at the Goldsmiths' Institute, New Cross, last Wednesday, Mr. A. G. Bloxam, F.I.C., Professor of Chemistry at that establishment, read a paper on "Cyanides from Bye-Products." Mr. Frank Livesey, the Chief Engineer of the South Metropolitan Gas Company, presided.

The Chairman, in a few opening remarks, said it was not necessary for him to introduce Mr. Bloxam to the members, because he was already so well known in connection with work of this kind. He (Mr. Livesey) was present, like the rest, to learn something about this very interesting subject, because now that gas companies were manufacturing more gas, they were producing more coke and ammonia, and other people were also joining in. Therefore, they were not making coke and ammonia in accordance with the demand, but they made these products in accordance with the demand for gas. In this way, their production was not carried on strictly upon ordinary commercial business principles. The position was therefore this: There was a great deal too much coke in London for the requirements; and he supposed he might say the same of ammonia, seeing that it was selling at £13 per ton about eighteen months ago, and now they could not get £8. This was evidence, he thought, that there was over-production. Also in regard to tar, he could not say there was a very bright prospect, though one of the products of this residual—benzol—had lately been selling well. Taking these things into consideration, they had to look afield to see if they could not find something else to bring in a little more money to the till. This was all the more necessary because they had a very serious competitor in the electric light; and the prosperity of gas companies depended upon the selling of gas cheaply. Therefore, it was necessary that all connected with gas-works should exert themselves to bring in a new product. The question to be dealt with by Mr. Bloxam had come to the front lately in consequence of the use of cyanide in the extraction of gold; and while the mines were busy in the Transvaal, it gave a spurt to the demand for it. For the present, it had fallen back a little, in consequence, he supposed, of the disturbances in South Africa. There was no doubt the material would be required for some time to come; and it would be very largely used if it got a little cheaper. Ferrocyanide of soda, he was told, had come down to 4½d. per lb., while it had been selling at 1s. Still, he believed they could make a little profit from this new branch of business. He was at work on it himself; and therefore he was much interested in the subject. He must, however, confess that he knew Mr. Bloxam could enlighten him on the chemical part of the subject. They must look to gentlemen such as Mr. Bloxam to help them further; for he was sure there were many improvements to be made in gas manufacture in which chemists could assist them—for instance, there was the question of carbonizing. They put the coal into the hot retort, which immediately brought down the temperature; and this represented a very considerable loss. They were thus producing gas at the beginning of the charge at a comparatively low temperature; whereas at the end, the temperature (as in all things connected with gas-works) was greatly increased. This was a point that had not been investigated so much as it ought to be; and when it was, he believed they would find out something which would be very beneficial.

Mr. Bloxam proceeded to read his paper, various portions of which he enlarged upon and illustrated by experiments.

The first part of the paper dealt generally with the origin and practice of the potassium cyanide process in the extraction of gold; the successful application of this chemical to the work having, remarked the author, widely extended its market. Mr. Bloxam then proceeded: I regret that I have no data at hand to enable me to form an estimate of the position of British trade in cyanides. But I learn from a consular report that in 1892 Germany exported to the Transvaal 1658 cwt. of potassium cyanide, valued at £11,372; while in 1895 the figures were 18,484 cwt. and £147,000 respectively. It is to be feared that the figures for the United Kingdom would not be so favourable; and I am afraid that the backwardness of our gas industry in the matter is one reason for this.* Potassium cyanide is to-day quoted at 1s. 2d. per lb.; ammonium sulphate, at £8 per ton—*i.e.*, a little under 1d. per lb. Since they contain nearly the same percentage of nitrogen, this is also approximately the ratio of the value of the nitrogen in them. The cyanide must always be more costly to recover than ammonium sulphate, but certainly not fourteen times as costly.

The basis of all cyanides is the gas cyanogen CN, or more correctly C_2N_2. It may be said that the prime difficulty of producing cyanides resides in the fact that cyanogen is more energetic, weight for weight, than a mixture of carbon and nitrogen in the proportion in which they exist in the compound. Thus it happens that, in order to produce cyanogen from its elements, energy must be imparted to them. Hence carbon cannot be made to burn in nitrogen save at heat-pressures (temperatures) sufficiently high to ensure the introduction of the necessary energy into the system. In burning carbon in oxygen, a compound—carbonic acid—is produced which is less energetic, weight for weight, than is a mixture of its elements in the proportion in which they exist in the compound. So that, when causing carbon and oxygen to combine, we are, as it were, drawing upon their current accounts at the energy bank—a process notoriously more easy than its converse. It has been alleged that cyanogen is produced in small quantities when electric sparks are passed between carbon electrodes in an atmosphere of nitrogen; but beyond this the direct combination of carbon and nitrogen does not appear to have been observed, unless we admit that the formation of cyanogen in the blast-furnace arises from direct combination of its elements—a point which is, to my mind, open to considerable doubt.

Cyanogen is what is termed an acid gas—*i.e.*, it has a powerful affinity for alkalies, like potash, soda, lime, and baryta; so that it combines readily with these. If, therefore, one of them be present when carbon and nitrogen are very strongly heated together, it encourages the formation of cyanogen by immediately combining with the gas, when it is formed, to produce a cyanide. For example, it has been found to be possible to make barium cyanide, $Ba(CN)_2$, by passing nitrogen through a retort in which a mixture of barium carbonate and pitch is being heated at about 2500° Fahr. This indisposition of nitrogen to enter into direct union with carbon is typical of the behaviour of the element towards the majority of its colleagues. Now when an element shows this idiosyncrasy, it is necessary to have recourse to indirect methods of producing its compounds; and these methods are generally based on the fact that it is, in such cases, easier to transfer the element from one form of combination to another than to induce its direct combination. Better yields of cyanide, for instance, are obtained by substituting ammonia for nitrogen in processes of the type mentioned above. At one time, such a substitution was not to be thought of, since the sole desire of the inventor was to produce cyanide as an intermediate product in the manufacture of ammonia from atmospheric nitrogen. Now, however, the scene has shifted; and there are few producers of ammonia who would not gladly convert a portion of it into cyanides, pending the inevitable fall of prices. It has long been believed that, when an alkali is heated with carbon and nitrogen or ammonia, no appreciable quantity of cyanide is formed below the temperature at which the carbon can deprive the alkali of its oxygen—liberating the alkali metal, which then combines with another portion of the carbon and with nitrogen to form the cyanide. If this be the case, it were better to substitute a previously prepared alkali metal for the alkali, since a lower temperature might then serve. Accordingly, in Castner's process, by which, I believe, sodium cyanide is now being produced in Birmingham, metallic sodium is caused to flow down a column of heated coke, up which ammonia is passing.

After a reference to waste animal matter—such as blood, horns, leather, and the like—as a convenient source of nitrogen for preparing cyanides, the author continued: Besides the cyanides and ferrocyanides, cyanogen is also in slight demand in the form of sulphocyanides, chiefly potassium sulphocyanide, KCNS. This compound is easily formed by adding sulphur to molten potassium cyanide; but it is more cheaply prepared by taking advantage of the fact that, when ammonia and carbon bisulphide are heated together at about the temperature of boiling water, preferably under pressure, ammonium sulphocyanide is formed, thus— $CS_2 + 4NH_3 = NH_4CNS + (NH_4)_2S$. In practice, it is economical of ammonia, and at the same time diminishes the pressure in the apparatus, to add lime to the charge, so that the final products are calcium sulphocyanide and sulphydrate—

$$2Ca(OH)_2 + 2CS_2 + 2NH_3 = Ca(CNS)_2 + Ca(SH)_2 + 4H_2O.$$

The calcium sulphocyanide is convertible into the potassium salt by treatment with potassium carbonate—

$$Ca(CNS)_2 + K_2CO_3 = CaCO_3 + 2KCNS.$$

The process becomes of much importance in connection with the possibility of desulphurizing the sulphocyanide so as to obtain potassium cyanide.

I have now laid before you the chief methods by which carbon and nitrogen may be brought into combination for the South African market. I need hardly say that, since the demand originated, patents for the production of cyanides have been very numerous; the 1895 crop including no fewer than 33 specifications, as against 7 in 1892, which was the most prolific year since 1886. The gas industry has the great advantage over other producers that cyanogen is formed as an essential part of the destructive distillation of coal; and it is for the gas engineer to consider carefully whether means may not be adopted either to so increase the yield or to so decrease the cost of recovery that even the smallest gas-works may contribute its quota of cyanides as it does of ammonia—thus driving all other competitors from the field. Nothing but diligent study of the subject, followed by due experimentation, can achieve this end; and it behoves us in the first place to consider what is known with regard to—(1) The origin of the cyanogen during carbonization; and (2) the forms and localities in which the cyanogen appears during the process of purification.

Two possibilities present themselves in connection with the origin of the cyanogen. It may be formed (*a*) as a secondary product, resulting from the interaction of the gases during their

* Since writing the above, Mr. Bloxam has been informed by a dealer in cyanides that he is of opinion that the British trade is quite comparable with the figure quoted for the German trade.

sojourn in the retorts, or of these with the hot coke; or (*b*) as a primary product, resulting from the break-down of some nitrogenous compound in the coal. The majority of investigators seem to have viewed the first of these two possibilities as the more probable, and have sought to obtain cyanogen on a small scale by bringing together at high temperatures such gases as are known to be present in the retort, either in the presence or absence of charcoal or coke. Experiments of this kind have recently been repeated by Bergmann, who has corrected certain errors of former observers.* He finds that, when ammonia is led through a tube containing charcoal heated at 1000° C. (approximately the temperature of the gas-retort) hydrocyanic acid (not ammonium cyanide, as heretofore stated) is produced; such portion of the ammonia as is not thus converted being decomposed into nitrogen and hydrogen. The yield is increased if the ammonia be diluted with coal gas—a condition obtaining in practice—although this does not seem to be due to any interaction between the ammonia and the gaseous carbon compounds. I can, however, state from my own experience that coal gas and ammonia will give rise to hydrocyanic acid at temperatures decidedly below that of the gas-retort. The reaction between coke and ammonia may be expressed by the chemical equation $C+NH_3=HCN+H_2$, and is one which may be considered likely to occur in the retort. Bergmann has discredited the view that carbonic oxide and ammonia react in the retort in accordance with the equation—

$$CO + NH_3 = HCN + H_2O;$$

for he finds that this change takes place to a very limited extent even at 1100° C. I have myself recently tested a third view—viz., that ammonium sulphocyanide may be formed in the retort by the interaction of carbon bisulphide and ammonia—

$$CS_2 + 2NH_3 = NH_4CNS + H_2S.$$

I find that, in the presence of hydrogen, ammonium cyanide is the product of this reaction, not sulphocyanide. This is in agreement with Knublauch's statement that crude gas contains no sulphocyanogen. If the cyanogen be, in fact, a product of the attack of the hot coke by the ammonia, its formation should be in some measure dependent on that of the latter. Experiments are wanting to show at what stage of the distillation the cyanogen chiefly appears. Is it really the high temperature product that the above view of its formation would imply, and Lewis T. Wright's experiments seem to show? If not, then the possibility that it is a primary product of the distillation will be favoured.

The cyanogen leaves the retort in the form of hydrocyanic acid; ammonium cyanide not being capable of existence at temperatures above 36° C. It constitutes about 0·1 per cent. by volume of the gas—say, from 75 to 100 grains per 100 cubic feet. The nitrogen in it represents about 1·5 per cent. of that in the coal; or 0·023 per cent. of the weight of the coal. Supposing that all this were recovered as potassium cyanide, there would be obtained about 1 ton per 1000 tons of coal.

Following the destiny of the cyanogen, we have first to consider the liquor in the scrubbers and washers. It is rather surprising that no ammonium cyanide occurs in this liquor, since there is an abundance of ammonia with which the hydrocyanic acid might combine, and the temperature is below that at which ammonium cyanide can exist. It can only be supposed that, in the struggle which occurs between all the acid gases present for the ammonia, the hydrocyanic acid comes off worst, and is compelled to move on. Nevertheless, ammonium sulphocyanide and ferrocyanide do occur in the liquor. The ferrocyanide is probably formed by the action of the hydrocyanic acid on ferrous sulphide in presence of the ammonia—

$$6NH_4CN + FeS = (NH_4)_2S + (NH_4)_4FeC_6N_6.$$

The iron sulphide would, of course, originate in the ironwork of the condensers and washers. The presence of sulphocyanide is not quite so easily accounted for. It has been suggested that a small quantity of oxygen in the coal gas oxidizes some of the ammonium hydrosulphide in the liquor, forming ammonium persulphide, which then combines with the HCN to form sulphocyanide—

(1) $2NH_4HS + O = (NH_4)_2S_2 + H_2O.$
(2) $(NH_4)_2S_2 + HCN = NH_4CNS + NH_4HS.$

It is possible, however, that the sulphocyanide, or a part of it, is a product of the interaction of carbon bisulphide and ammonia in the washer, according to the equation that has already been given. In this case, the cyanogen of the gas is in no way responsible for the sulphocyanide. On this account, it is difficult to say what proportion of the cyanogen which leaves the retort is retained in the washing liquors. The same remark applies to the calcium sulphocyanide found in the lime; for, when ammonia escapes the washers, it reacts with the carbon bisulphide in the lime purifiers. In the ordinary course of purification, the iron oxide undoubtedly retains the largest proportion of the cyanogen, particularly when oxide vessels precede the lime. The current opinion is that the hydrocyanic acid forms a ferrous cyanide by reacting with the ferrous sulphide in the oxide purifier—$FeS + 2HCN = Fe(CN)_2 + H_2S$. When the oxide is revivified, this ferrous cyanide becomes oxidized to prussian blue (ferric ferrocyanide)—

$$9Fe(CN)_2 + O_3 = Fe_4(FeC_6N_6)_3 + Fe_2O_3.$$

The blue accumulates in the purifying mass until the spent oxide contains several per cents. of the pigment.

In Germany, hydrated ferric oxide is more frequently used in the first purifiers than it is in this country; hence spent oxide is there much worked for the sake of its cyanides. A masterly paper by Knublauch* deals with the conditions necessary for producing spent oxide containing the maximum quantity of prussian blue. Unless these conditions be fulfilled, much of the cyanogen appears in the spent oxide as sulphocyanide, which is less easily dealt with. The chief desideratum is the complete removal of ammonia before the gas passes into the purifier, since this ingredient encourages the formation of sulphocyanide. Under these circumstances, the oxide should take up cyanogen equivalent to from 17·5 to 21·0 per cent. of potassium ferrocyanide, calculated on its dry weight, before it is spent; and this amount should represent some 66 per cent. of the cyanogen leaving the retorts. Leybold has stated that it is well to use as the first purifier an oxide vessel which has ceased to take up sulphur, and is sufficiently large to entail slow passage of the gas.

It is now necessary to consider what means are at present available for recovering the cyanogen from the bye-products. We have seen that it is present in two forms—viz., as sulphocyanide (of ammonium) and as ferrocyanide (of ammonium and of iron); and that it is possible to favour, to a certain extent, the formation of the latter at the expense of the former. We shall see presently that the whole of the cyanogen may be obtained as ferrocyanide or as sulphocyanide by altering the present system of purification, in the one case to a small extent, in the other radically. But first the method available without any alteration of the present system, except perhaps a shift of purifying vessels, demands attention. Cyanides have for many years been made in Germany from spent oxide; and in this country two firms, I believe, are at the present time engaged in the work. Details of the processes adopted are not made public; but the following chemical principles are applied: The prussian blue in the spent oxide is insoluble in water, while the ammonium sulphocyanide is exceedingly soluble. Consequently, extraction with warm water will remove the sulphocyanide; and when other soluble salts are present but in small amount, the aqueous solution may be evaporated to recover the sulphocyanide. In other cases, resort may be had to the insolubility of cuprous sulphocyanide, CuSCN, which is precipitated as a white powder when sulphurous acid and copper sulphate are added to a solution containing a sulphocyanide. The cuprous salt may be converted into the potassium salt by boiling with potassium carbonate—

$$2CuSCN + K_2CO_3 = Cu_2O + CO_2 + 2KSCN.$$

After the removal of the sulphocyanide, the mass containing the prussian blue is dried, mixed with caustic lime, and heated in closed vessels by means of steam. In this way, calcium ferrocyanide is formed—

$$Fe_4(FeC_6N_6)_3 + 6CaO = 3Ca_2FeC_6N_6 + 2Fe_2O_3.$$

This salt is soluble in water, and is accordingly leached out. To convert it into potassium ferrocyanide, potassium chloride is added to a boiling solution of it, whereby the insoluble calcium potassium ferrocyanide, $CaK_2FeC_6N_6$, is precipitated. This compound is then boiled with potassium carbonate to complete the conversion; the calcium being converted into the insoluble carbonate—

$$CaK_2FeC_6N_6 + K_2CO_3 = CaCO_3 + K_4FeC_6N_6.$$

The solution of potassium ferrocyanide is evaporated to obtain the crystallized salt, $K_4FeC_6N_6\,3H_2O$.

In the case of the ammoniacal liquor, the recovery is somewhat simpler, since the ferrocyanide is already in a soluble form. The residues from the ammonia stills contain the sulphocyanide and ferrocyanide in the form of the calcium compounds, since the lime which has been added to expel the fixed ammonia has taken its place in the two salts. The sulphocyanide may be separated, and the ferrocyanide converted into the potassium salt, in the manner already described.

It was suggested by Knublauch that a more rational way of dealing with cyanogen in gas manufacture than the present method would be to convert the whole of it into ferrocyanide directly, by taking advantage of the fact that, in the presence of ferrous sulphide and an alkali, hydrocyanic acid is converted into the ferrocyanide of the alkali. The conditions can readily be obtained by adding an iron salt to the water in the washer; for this is certain to be alkaline from the presence of ammonia, while the added iron will at once become ferrous sulphide by the action of the ammonium hydrosulphide. I have not perhaps laid sufficient stress upon the point that, although ammonium cyanide is incapable of existence in the presence of the large quantities of sulphuretted hydrogen and carbonic acid which pass through the washer, ammonium ferrocyanide holds its cyanogen so much more firmly that it is stable in the presence of these gases. The recovery of ferrocyanide from the ammoniacal liquor, if this process be adopted, will be carried out as already indicated. Diverse forms of iron have been suggested as convenient for introduction into the washer for this process; but I am not aware that any one of them has particular claim for preference, except on the ground that, if the iron be introduced in the form of a salt, the acid radicle of that salt will

* See "JOURNAL," Vol. LXVII., p. 1032.

* See "JOURNAL," Vol. LXVI., pp. 1242, 1294.

render fixed an equivalent portion of the ammonia in the liquor—thus diminishing the so-called free ammonia.

It is, I think, an obvious improvement of this plan to effect the absorption of the hydrocyanic acid, not in the washer itself, but in a small subsidiary one inserted after the main washer, and to introduce caustic soda and the iron salt into this vessel. The advantage will be obtained that sodium ferrocyanide will be directly produced, and the proportion of free to fixed ammonia in the main washer will not be disturbed. The sodium salt can then be obtained by direct evaporation of the liquor. This is, I believe, the essence of a process for which a patent has been claimed; ferrous carbonate being the particular form of iron employed. There is no special virtue in using ferrous carbonate; but there is an advantage in robbing the iron salt of any fixed acid radicle before introducing it into the washer, since it is undesirable to have to separate a soluble sodium salt from the ferrocyanide.

It will be noted that the methods just dealt with recover the cyanogen in the form of ferrocyanides. Now, it will be clear from what was said at the beginning of this paper, that the modern demand is not for ferrocyanides, but for cyanides. Unfortunately, there is an inherent difficulty, which I have attempted to explain, in the recovery of the cyanogen directly in the form of cyanides; and, as a result, every pound of cyanogen which is taken from the gas-retort to South Africa must go through the form of either ferrocyanide or sulphocyanide. This being the case, the question naturally arises, Which is the less thorny path to follow? "By way of ferrocyanide" would have unhesitatingly been the answer until a few years ago; but now a doubt arises. Potassium ferrocyanide can be converted into cyanide by mere ignition out of contact with air, but not without the loss of a third of its cyanogen, as shown by the equation $K_4FeC_6N_6 = 4KCN + Fe + C_2 + N_2$. This loss is largely prevented by adding potassium carbonate to the ferrocyanide before ignition, whereupon five-sixths of the cyanogen becomes cyanide, and one-sixth an oxidized product, potassium cyanate, KCNO—

$$K_4FeC_6N_6 + K_2CO_3 = 5KCN + KCNO + Fe + CO_2.$$

This cyanate is useless; and it is, therefore, sought to suppress it by adding charcoal to the charge—

$$KCNO + C = KCN + CO.$$

Pretty as these equations are they are, I fear, seldom quantitatively realized. It has therefore been proposed to melt the ferrocyanide with sodium; thus obtaining a mixture of KCN and NaCN good enough for the miner's purpose—

$$K_4FeC_6N_6 + Na_2 = 2NaCN + 4KCN + Fe.$$

Sodium or potassium sulphocyanide merely needs the removal of sulphur to convert it into cyanide. It seems that success is likely to attend a method consisting in heating the sulphocyanide with zinc; thus removing the sulphur as zinc sulphide—

$$KCNS + Zn = KCN + ZnS.$$

If this be the case, it may be better to attempt the recovery of the whole of the cyanogen as sulphocyanide in the gas industry, particularly in view of the possibility of somewhat increasing the yield at the expense of the obnoxious carbon bisulphide and of some of the discredited ammonia, as mentioned above.

If the cyanogen be preferably recovered as sulphocyanide, then I see no better plan at present than that which was suggested in the Claus process for purifying coal gas.* With the process as a whole, I have nothing now to do. The principle contained in it to which I would call attention is the conversion of a portion of the ammonium hydrosulphide, NH_4HS, into bisulphide $(NH_4)_2S_2$, by dissolving sulphur in it, and then using this as an absorbent for the HCN; producing sulphocyanide, thus—$(NH_4)_2S_2 + HCN = NH_4CNS + NH_4HS$. Nothing is easier than to write this reaction on paper, and to suggest that it could be effected in a subsidiary washer!

In this paper, I have endeavoured to put before you some of the reasons why we should bestir ourselves concerning cyanides, some of the biography of gas-retort cyanogen, and some of the principles underlying the recovery processes. My apologies are due to you that it is not more succinct, and not more complete.

On the proposition of Mr. G. P. Lewis (the Chairman of the Society), seconded by Mr. C. Tanner, jun., a cordial vote of thanks was passed to the author of the paper.

Mr. Bloxam, in responding, mentioned that Dr. C. A. Doremus, Professor of Chemistry at the City College, New York, was present, and could give the members some interesting information upon matters relating to gas supply in America.

Gas-Works Practice in New York.

Dr. Doremus, on the invitation of the Chairman, said that gas-works practice was so utterly different in England from what it was in the United States that he was present that evening to learn something about the methods in use here for regaining valuable bodies from the waste products. In New York, he supposed that, of the output of gas, quite three-quarters was oil gas with a base of water gas. The temperature of the retorts was very nicely controlled in the manufacture of oil gas by the use of oil fuel. In some of the largest gas-works, the fuel oil, or more particularly gasolene, was allowed to trickle into the retorts; and these were kept at a constant temperature day in and day out. The output was therefore very uniform; and since they found this enriched gas had a very high heating co-efficient, it was used not only for lighting, but for heating. They gave a pressure of 7 to 5 inches in the mains. This was very excessive; and there was, in consequence, a considerable amount of leakage. But all the companies had been obliged to give a high pressure, on account of the great consumption of gas for fuel, which was increasing constantly; and, in order to overcome the leakage, they were now using new wrought-iron or steel pipes, with screwed joints. They had almost entirely given up the use of cast-iron and lead pipes. The introduction of acetylene, through the production of calcium carbide, was going to make some changes in their gas production on the other side, as it might eventually do here. As yet, they had not been able to produce with the acetylene alone an illuminating gas for service. They found they could not increase the illuminating power of water gas even by adding acetylene in considerable quantity, though, added in smaller proportions to coal gas, it did very well. Attempts were going to be made—especially if calcium carbide became a really commercial article—to use acetylene in connection with the hydrogen of water gas to produce olefiant gas; and thereby they would get almost any illumination, and a gas that would be much more manageable. The average illuminating power of New York gas was 25 candles. The introduction of the Welsbach light was extending very rapidly in all directions. With regard to the recovery of products such as Mr. Bloxam had dealt with, they were as yet doing very little; but the competition of the electric light was making the companies keener in that respect.

Dr. Doremus was thanked for the interesting particulars he had given; and this concluded the proceedings.

* See "Journal," Vol. XLIX., p. 307.

TEXAS GAS AND ELECTRIC LIGHT ASSOCIATION.

Annual Meeting at Dallas.

The Second Annual Meeting of this Association was held on the 12th and 13th ult. In the absence of the President (Mr. W. E. Holmes), through illness, Mr. T. D. Miller took the chair. In the course of the routine business, 15 members were added to the Association.

Mr. H. L. Munroe read the President's Inaugural Address. This was mainly directed to the affairs of the Association. The appointment of Standing Committees of three members each, to deal respectively with general business, finance, constitution and bye-laws, membership, and legislation, was suggested. Attention was directed to the increased number of State Associations, which, it was expected and hoped, would lead to the establishment of a National Association, made up and managed by representatives from the State Associations. He also suggested Special Committees for arranging details, such as place of meeting, programme, &c., and that the advantages of the Association should be brought before the chairmen and directors of the various companies in the district.

Mr. A. E. Judge, of Tyler (Texas), followed with a paper on "Our Association," in which he considered the advantages to be gained therefrom, and offered several sound practical suggestions as to methods of conducting business, so as to enable them to be obtained to the fullest possible extent.

Mr. W. A. M'Goldrick, of San Antonio, read a paper dealing with one year's experiences in that city; remarking that he occupied a somewhat peculiar position as manager of the gas department of a company which also owned an electric light installation replete with every modern improvement. He was, for one thing, under the disadvantage of having several meters that were only used when the electric light failed or was out. However, he made the best of it, by carefully locating all the street syphons, seeing they were clear, putting the governor in good working order, cleaning out services where necessary, overhauling the consumers' fittings and introducing the Welsbach and other modern burners, and, lastly, taking care to supply gas of a high uniform quality. It was no good to sell people the Welsbach light, and then leave them to look after it. He found it worth while to take some trouble in teaching the way of using; and he visited every consumer who had more than four burners once a week, to keep them in good order. He would not sell mantles over the counter, but sent and fixed them, thus making sure that they were properly fitted. He much preferred mica chimneys to glass ones. He found some of the meters placed too near to stoves or flues, and some in damp places on the ground, with the lower part corroded. He altered all this, and placed the meters in cool, dry positions. He was also doing all he could to develop the use of gas cooking-stoves.

Discussion being invited, Mr. Fitzgerald said that he followed the example set in the paper, of keeping the incandescent lamps clean and in good order without charge to the customer. He did not, however, like the mica chimneys, as they soon discoloured and scaled inside, and when once discoloured could never be made to look like new. Mr. Judge knew a person who was using the Welsbach with air gas. The breakage of mantles was heavy; but the gentleman said that he could return broken mantles, and get an allowance on them. The Chairman said

that a 5-inch mica chimney, with a canopy, reduced the illuminating power below that furnished by a 7-inch chimney without a canopy. His experience with the incandescent light at Dallas had been most satisfactory; and it competed well with petroleum. The frail character of the mantle was the chief objection; but he heard that attempts were being made to improve this. It was true that the Welsbach Company would allow a credit for clean mantle dust and platinum wires. As it was, the average life of a mantle was over 1000 hours. Mr. M'Goldrick, in reply, said there were several kinds of mica chimneys. He used a one-ply, and had little trouble with it. He could clean it with tissue paper; and his consumers did not object to a little reduction in candle power. He was using Lungren lamps successfully in connection with prepayment meters. He agreed that the average life of a Welsbach mantle was 1000 hours.

A paper entitled "Electric Light Companies and their Customers," was read by Mr. L. T. Fuller, President of the Calvert (Texas) Water, Ice, and Electric Light Company. He said that, as now constructed, the electric light plants were great institutions for users of light; but they could not all be paying investments, and the point for the managers was to make them yield dividends. They wanted to get at the actual cost of furnishing electric light—not based on manufacturers' estimates, but on actual practical working. Much disappointment and loss had been caused by failure to realize in practice the results claimed by makers of machines. There were leaks at the works, and on the lines, and by means of consumers who got more than they contracted for. The question of the best way of dealing with customers so as to get them to pay for what they had, was most important. In spite of rigid forms, penalties, &c., he found that customers would use larger lamps and for longer hours than their contract warranted. He would like to hear something about the advisability of charging differential rates according to quantity taken; and whether, in small districts, it paid to have separate lines for the different hours of lighting. Also as to the percentage of lights in use, as compared with the total number wired; and the desirability of basing the charge on the last-named figure—that is, to have a minimum charge per light wired, whether used or not. Then there was the question of controlling sale of lamps, so as to prevent the use of cheap, inferior articles, which were a cause of loss of energy, and the best methods of collecting or settling accounts.

Mr. Cullinane led off the discussion by remarking that the electric light supply was at present in the same position as that of gas before the introduction of meters; but he hoped the day would soon come when there would be accurate meters both at the works and in the consumers' houses. It was now really a matter of guesswork how much current was sold and how much lost. There had not been an electric meter on the market yet that came anywhere near the gas-meter for accuracy. If there was one to be had, they would all use it. Mr. Eddy said he had 1800 incandescent electric lights in use; and his difficulty was that, when he asked his directors to put in meters, they wanted him to positively guarantee that the earnings would be increased. Mr. Taylor sold on the basis of an ampère meter, on the understanding that the consumer could use it as long as the supply was kept up, which might be from 2 p.m. to 11 a.m. next day. Mr. Starr said that, at Gonzales, he charged in advance, and had a system of inspection to see that the consumer did not exceed his contract. He used watt meters, and regarded them as fairly satisfactory. If necessary, he tested them at the works; and he found that for a given number of lamps the measurement was about the same. Vibration would cause the meter to work when no current was passing. Mr. Monroe said there were accurate electric meters to be had. He would supply a meter under guarantee of 5 per cent. margin at the outside. It would be utterly impossible to do a remunerative business on any other than a meter basis. The efficiency of lamps varied a great deal—some using half as much current as others to produce a given light; and this was an important matter, when supplying by contract. The ampère meter varied according to the voltage; but a watt meter was accurate and reliable. Mr. Fraser, the City Electrician of Dallas, thought it was possible to get a reliable meter, and that superintendents, instead of looking after their customers only, would do well to pay more attention to the lines and connections round the engine-house. He believed there was more loss from leaks in the engine-house than from stealage by the customers. Electric light meters were as delicate as watches, and should be carefully cleaned every six months. Every man going into the wiring business, should be examined by a competent board, and also be put under a bond to do good work. No new work should be connected on till it had been properly inspected. Transformers should never be placed in a building. The Chairman, speaking as a gas man, said that just as one consumer using old fishtail burners might have a much higher gas bill than his neighbour who used incandescent burners and got a great deal more light, he understood that there was a great difference in the efficiency of electric lamps, and that one man might get less light and yet actually use and have to pay for more current than his neighbour.

Mr. T. D. Miller, of Dallas, followed with a paper on "Fixed and Variable Expenses in Manufacturing Plants;" dealing with interest on capital and depreciation as fixed items, and wages, material, establishment expenses, taxes, insurance, &c., as variable items. Many persons, in dealing with the profit earned, took account of the latter only; but capital was as worthy of its hire as the brain and sinew of the wage earner. As to depreciation, the plant receded in value every year; and unless this was provided for regularly, difficulties would sooner or later arise. The value of the plant must be kept on an equilibrium with the invested capital. It was possible to show large earnings, by charging everything possible to capital; but this was apt to lead to trouble if the business did not increase. Care should be taken to charge every repair and renewal to revenue; and if there was any doubt, he preferred to let capital have the benefit. He instanced a municipality which for some years stood high as selling cheap gas and making good profits. But this was done at the expense of the plant, which was not kept in proper repair; and at last it came to buying gas from neighbouring companies, because their own plant was worn out. In another case, a municipal electric plant was stated to show a cost of only 1·1d. per horse-power hour. This, he went on to show, included variable charges only. After adding the fixed charges, the cost would be 2½d. per hour, or equal to about £28 per annum for an arc light. In two other instances, where the cost was put at 1½d., he proved that it really was not less than 3d.; bringing the arc lamp to about £34 per annum. In a fourth case, the cost was put at 0·5d., which, with the incomplete data at disposal, he readily showed to be absurd. Yet all these figures were adduced as evidence in favour of towns adopting electric lighting.

A paper by the President followed, on "Municipal Ownership." It was read by Mr. Taylor. This question, with the side issue of whether municipalities had any right to regulate prices or put unusual restrictions on companies operating in their district, was one of the most important problems of the day. He regarded it as a mischievous evil, the only remedy for which was to educate the people in the theory and practice of finance and political economy. A wise and conciliatory policy on the part of the company was not always a preventative; but sometimes it seemed to increase the demand for a cheaper and better supply, which was the great battle-cry of advocates of municipal ownership. The law of Massachusetts, though not perfect, was probably the most clear, just, and equable of any of the State laws bearing on this subject; being guiding and instructive, rather than restrictive. The result was that in 143 districts where light was sold, only 12 plants belonged to municipalities; and most of those were small. In their own State, the municipalities were practically without guidance or control from State laws. They established lighting plants, with no limitations as to price, no uniform system of keeping accounts, no unbiassed auditing; so that no one could get at the real working costs, or the profits. The disadvantage of this was that many municipalities were led to believe that they could do things better or cheaper than the companies did. With their years of experience, it was difficult to believe that people could be so deceived; but they must remember that the Committees who decided these things usually knew nothing about them, so far as business experience was concerned. If there were laws guiding the construction, maintenance, and working of lighting plants by municipalities, requiring accounts of each department to be kept in a clear and distinct form, accurate reports to be published at regular intervals, and each department to be self-sustaining, gas shares would be more valuable; and much would be saved to the ratepayers. The companies did not want to charge more; but they needed protection from ill-advised municipal competition.

Mr. Fitzgerald, in commencing the discussion, said that the position taken up in the paper was very desirable, but impracticable. There would always be more or less selfishness in municipal works; and every possible objection would be raised to keeping or publishing accurate accounts. Another great difficulty was that municipal affairs were all managed on a kind of political basis; and managers were changed, or men put into subordinate positions, through personal favouritism. Mr. Oliger said that the previous speaker touched the key-note when he spoke of municipal plants being made use of for political purposes. The Chairman remarked that many people voted for municipal ownership, without going into the merits of the case, just for love of change. Mr. Fraser said that he was not in favour of municipalities owning anything at all, though he was a municipal officer. At election times, there were always a lot of men waiting for a job; and the question was not whether an applicant was competent—say, to manage the electric works—but whether he had influence to pitchfork him in. If the city authorities would run a plant as the companies did, and put men in charge who were competent and would work it to the best advantage, there was no reason why they should not do as well; but they would not, as they had friends wanting positions. Under such circumstances, it was bound to fail. Many companies were promoted by contractors for erection of plant, who raised the capital to three or four times as much as it ought to be; and this made it necessary to charge the consumer a high price, and led to discontent.

Mr. H. L. Munroe, of Dallas, read a paper on the "Use of Electric Meters," in which he argued that, just as coal, gas, and other necessaries were bought by weight or quantity, and not by estimates based upon the consumption of such commodities by other people, so electricity ought to be sold in the same

way. Gas-meters were generally adopted as soon as they were proved to be reliable; and now that electric meters were put on the market, electric lighting companies would find themselves compelled to follow the same lines. It had been well established that a central station operating a district on the meter system could supply 30 per cent. more lamps than if the contract system was in vogue; and the income per lamp would not be less. In the contract system, no matter how honest he might be, the consumer got into careless habits, and left lights in use that were not wanted. This also accounted for the fact that many people, after being used to contract rates, complained that the meters were not true. Supposing meters to be adopted, it was necessary to keep them in order. An electric meter required overhauling and cleaning every few months. The ampère meter was not a proper measure of value supplied; but the watt meter was. The meter should be placed where it would be free from vibration. An electric company needed a station meter quite as much as a gas company.

Discussion being invited, Mr. Judge enlarged on the importance of the electric station meter; and asked if the advantage of a watt meter over an ampère meter was sufficient to justify the exchange. Would the use of a recording volt meter at the station be of any benefit? Mr. Brooke described a difficulty that had arisen through a volt meter indicating 7 volts short. Mr. Fraser remarked that instruments should be kept in proper order. Mr. Munroe, in replying to Mr. Judge, recommended discarding the ampère meter in favour of the watt meter. There should not be any great variation in voltage. The trouble was that not enough was spent on good recording instruments. Very few stations in the State had a set sufficiently complete to make a reliable test.

The Question-Box was then opened. Mr. Fraser, in answer to an inquiry as to whether it would be better, in order to double the capacity of a 500-light plant, to add another similar machine or to buy a 1000-light dynamo, strongly recommended a second machine and engine. It would diminish risk of total breakdown; and the two could be worked to better advantage. The Chairman would certainly have a second engine and dynamo, and couple the whole up, so as to admit of as much variety in working as possible. In answer to a question as to the degree to which coal gas could be enriched without complaints of smoking, the Chairman did not believe in supplying gas of more than 22 or 23 candle quality. Another inquirer asked if 10-10ths, 20-10ths, or 30-10ths pressure was best for a gas-stove; and Mr. M'Goldrick said he gave a pressure of 17-10ths in the mains, so as to allow about 15-10ths at the stoves. Care should be taken that the supply-pipes were large enough. Other speakers agreed on about 15-10ths; and the Chairman said that the best pressure was the lowest that would run the stove successfully.

The usual votes of thanks were afterwards passed; and the meeting then closed.

TEN YEARS' PROGRESS OF THE GAS INDUSTRY IN GERMANY.

Dr. E. Schilling, of Munich, prepared a valuable and highly suggestive statistical memoir on this subject for the first day's proceedings at the recent meeting of the Association of German Gas and Water Engineers in Berlin. From the text of the paper in the "Journal für Gasbeleuchtung" of the 27th ult., we have gathered the following facts of general interest:—

The number of towns in Germany having gas-works for public supply has increased from 668 in 1885 to 724 in 1896. Concurrently the production at the old works has grown; so that the average yearly increase in the make of gas during that period has been 812 million cubic feet, which is considerably higher than any former rate of increase, notwithstanding the development of electric lighting. Taking the kilo-watt of electric energy as equivalent to 35 cubic feet of gas, which is a fairly just assumption when the different methods in which gas is consumed are borne in mind, the maximum productive capacity of the gas-works of German towns is about six times that of the electric lighting stations. The number of electric lamps and the number of gas-burners in use stand in nearly the same proportion. A computation from the increase in the make per hour during the same period shows that the gas production is growing at more than twice the rate at which the supply of electrical energy progresses. Thus far private electrical installations have not been taken into account. As a matter of fact, nearly double the number of lamps served by central stations are attached to small installations; whereas gas is rarely made in private works. The conclusion that must be drawn is that electrical energy is not so well adapted for supply from central stations as from separate installations. The fact that more than half the central stations cannot work up to more than 100 kilo-watts, and in many cases are in small towns without gas supply, bears out this conclusion.

A study of the gas consumption per inhabitant in towns with a population of more than 100,000 shows that it has decreased in a few, including Berlin, but increased in many more, during the past ten years. Of all German towns, Carlsruhe has the highest consumption per head—viz., 3425 cubic feet. The population of that town has increased by 54·7 per cent., and the gas consumption by 121 per cent., in the ten years. With regard to public lighting, gas is used in 724 towns, of which only 36 supplement it with electricity. Munich has more than one-half the total arc lamps in use for street lighting in the country. Berlin has 185 arc lamps; and the remaining 34 towns have only 474 to account for. On the other hand, 274,013 gas-lamps are used for public lighting, and consume 15·6 per cent. of the total quantity of gas produced. The consumption of the 15,644 engines supplied from the public gas-works has amounted to 17 per cent. of the gas employed for private lighting. The consumption for heating and cooking has grown to an extraordinary extent during the decade. Nevertheless the gas so used possesses only about one-thirtieth of the total heating value of the coke produced by the gas-works. The coke sold from the German gas-works now amounts to upwards of 1 million tons every year.

At the present time the annual make of gas in all the town works in Germany amounts to 25,903,000,000 cubic feet; and the largest daily make during the last year was 123,128,000 cubic feet. There were 27,073 mouthpieces in use, and 7856 miles of mains. The towns to which these figures refer have a total population of 16,896,500. The coal carbonized in the past year amounted to 2,725,523 tons, of which 28 per cent. was Westphalian and 28 per cent. Silesian. Nearly 17 per cent. was from England. Only 1155 tons of oil, and smaller quantities of benzol and resin, were used as enriching materials.

THE CORROSION OF IRON BY RAW TAR.

At a recent Meeting of the Nottingham Section of the Society of Chemical Industry, Mr. F. J. R. Carulla read the following paper on the above subject:—

Coal tar is very extensively used for protecting from rust iron surfaces exposed to the weather, especially in chemical works where the atmosphere is more than normally destructive of this metal. This is the reason for bringing before you a remarkable example—or what appears to be one—of the danger that the careless or ignorant use of raw tar as a substitute for paint may entail. I have here two bolts, originally 12 in. by 1¼ in. thick, which are so thoroughly corroded as to present the appearance of having been soaked in some dilute acid for a considerable time. They were found in this condition when taken out of the valve-boxes of a pump through which only water from a well for the general supply of the works had been passed. The bolts which act as stops to prevent the excessive rise of circular india-rubber valves were always completely immersed in the water.

The only explanation of this corrosion that has been arrived at is that tar residues known to exist on the surface soil have communicated this undesirable property to the water in the well. A chemical examination confirms this. The water was found to be basic, which might be expected from its strong smell of naphthalene or gas liquor. It yielded on analysis—

	Parts per 100,000.
Total solids at 110°.	82·00
Free ammonia	0·43
Albuminoid ammonia	0·01
Chlorides expressed as chlorine	12·20
Carbonates expressed as $CaCO_3$	22·00

This water has eaten into the iron to such an extent as to show indentations in places exceeding ⅜ of an inch in depth. That this corrosive action is due to something communicated by the tar, would appear to be indicated by the fact that similar bolts in a pump at the same works used for raising tar, and that only, also show corrosion of a similar character although not quite so pronounced. The bolts in another pump, lifting river water in the same place, show no signs of corrosion, which goes some way to indicate the common origin of the damage in the two other cases.

From the analysis of the water given above, one may reasonably suspect that the presence of ammonium chloride, which is a considerable constituent of some gas liquors, and which therefore must be frequently present in crude tar, may contribute to the corrosive properties of this water. The remarkable character of the corrosion which is localized, and leaves much of the surface of the bolts almost untouched, suggests the formation of galvanic couples at a number of points in the neighbourhood of which the whole of the action has taken place. The oxide of iron that is sometimes present in wrought iron in the form of slag left between the laminæ of which such iron is composed, may account for this peculiarity.

Whatever the exact explanation may be, the examples certainly impress one with the necessity for neutralizing the cause of this corrosion before using crude tar as a protection for iron surfaces. Cases could be cited of gasholders that have been quite damaged by having been coated with raw tar without preparing it in any way. A note, abstracted from a German source, given in the "Journal of the Iron and Steel Institute" in 1892, is worth quoting, as it describes how tar should be prepared for use on iron, and is otherwise instructive: "Raw tar is not adapted for use in coating iron. The coating produced rapidly scales away and destroys the metal; the action being due to the carbolic acid which is present in the tar. If this tar,

however, is heated with 2 or 3 per cent. of lime to neutralize the acid, it may afterwards be used without injury to the iron, and at the same time give a satisfactory coating to the metal."

It will not escape notice that the carbolic acid is here given as the injurious constituent; whereas the contaminated water first referred to is of a basic character. As ammonia is also generally present in tar, it is not unreasonable to suppose that lime possesses a permanent neutralizing power for the acid that the volatile alkali does not possess.

It is almost superfluous to add that the carbolic acid so injurious to iron is the very thing wanted for the protection of wood. Therefore, when coating with tar a railway tank-waggon, for example, the proper method would seem to be, first to coat the ironwork with tar that has been heated with lime in the manner described, and after that to coat the wooden framework with raw tar.

In the short discussion which took place on the paper, Dr. Frank Clowes questioned the accuracy of the inference that carbolic acid was the active agent in the corrosion of iron by crude tar. Mr. L. Archbutt mentioned a case where creosote had leaked into an iron boiler; and corrosion certainly did take place. Mr. G. J. Ward remarked that galvanized sheets corroded rapidly if coated with tar as usually applied—*i.e.*, simply heated to drive off the ammonia. Mr. J. White pointed out that the analysis of the water that caused the corrosion showed only 0·43 part per 100,000 of free ammonia, while the chlorine as chlorides amounted to 12·20 parts. He was hardly disposed to think that, under the circumstances, any importance could be attached to the presence of ammonium chloride in the water. The quantity of carbonate of lime was rather high—being 22 parts per 100,000. The corrosion of the bolts was very similar to that which was in the spout of a kettle he once saw, and which he suggested might be produced by the action of dissolved carbonic acid gas; and it might be that the action upon the bolts was due to the same cause. Mr. Carulla said he concurred in the opinion that the question presented difficulties; but he had been induced to bring the subject forward on account of its practical importance.

THE DETERMINATION OF HIGH TEMPERATURES.

Two methods pretending to some degree of exactness are in frequent use for estimating the temperatures of furnaces. They form the subject of an interesting paper by Dr. H. Hecht, which is reprinted in "Der Gastechniker" from the pages of the "Thonindustrie *Zeitung*." The instrument used in the first method is the Le Chatelier pyrometer, which is now tolerably well known to our technical men. It consists of a thermocouple of platinum and an alloy of 90 per cent. platinum and 10 per cent. rhodium. When the temperature of one of the junctions is raised, a current, the strength of which varies with the difference in temperature of the junctions, passes through the circuit. The strength of the current is measured by a galvanometer placed in the circuit; and after calibration of the instrument from certain well-established melting-points or against the air thermometer, it is ready for use. Certain precautions must, however, be observed to obtain reliable results; and according to Dr. Hecht, the most necessary are: That the resistance of the wires leading to the galvanometer does not greatly exceed one ohm; that the wires are sufficiently long for the external junction to be at about the ordinary temperature of the air; that the wires are kept apart and protected from the action of gases and carbon by enclosure in externally glazed porcelain capillary tubes; that the galvanometer has a firm level base; and that the pointer returns to zero as soon as the current ceases. This pyrometer has an advantage over many others, in that the readings may be made at a considerable distance from the furnace, and the working of the latter may therefore be observed by the foreman or the works' manager without the furnace itself being visited.

The second method of estimating high temperatures described consists in the use of the Seger cones. These are specially suitable for use in porcelain and fire-brick works, as they show to some extent the effect of time as well as of the intensity of a furnace on the wares. The size of a furnace and the rapidity with which the high temperature is attained, affect the actual melting-points of the cones, as does also the oxidizing or reducing action of the flame. The melting-points ascribed to the higher cones of the series are in most cases higher than they should be. According to the mean of the results obtained in the careful researches of Violle, of Barus, and of Hollborn and Wien, the following are the approximate melting-points of certain metals:—

	Deg. C.		Deg. Fahr.
Silver	970	or	1778
Gold	1069	,,	1956
Copper	1076	,,	1969
Nickel	1496	,,	2725
Palladium	1572	,,	2862
Platinum	1806	,,	3283

Formerly the melting-point of platinum was estimated at 2000° C. The melting-points ascribed to the higher cones have been likewise too highly estimated. Assuming that certain cones correspond to the melting points given above, it would seem that the interval between the melting-points of consecutive cones of the series is 30° C. up to 950° C. (cone 010) and 20° C. above that temperature. Cones 20 and 36 melt respectively rather above the melting-points of nickel and platinum; and calculating the temperatures for the whole series with the above-named intervals, these cones correspond to 1530° C and 1850° C, which agree approximately with the melting-points of nickel and platinum according to recent determinations. From such considerations, Dr. Hecht has constructed a table of revised melting-points for the whole series of 58 cones; and he proposes to substitute the temperatures given in his table for those formerly ascribed to the cones. He hopes to have the figures he gives confirmed by comparison with the Le Chatelier pyrometer.

Both this instrument and the Seger cones are employed in the Royal Porcelain Factory at Berlin, in Dr. Schott's glass-works at Jena, and in the works of many other industries. As a result of Dr. Hecht's work, it may be surmised that temperatures ascertained by the Seger cones (see "JOURNAL," Vol. LXVII., p. 275) have hitherto been stated as considerably too high.

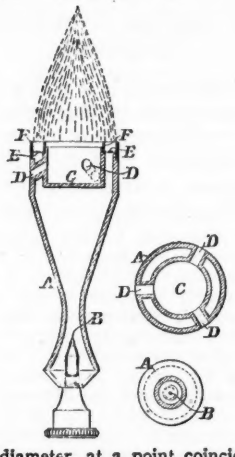
REGISTER OF PATENTS.

Heat Regeneration and Gas Manufacture for Internal Combustion Engines.—Fraser, J., of South Lambeth, S.E. No. 9188; May 9, 1895.

The principal claims for this invention are: 1. A method of utilizing the heat of the exhaust gases from a gas-engine by passing them through regenerators so as to absorb the heat, and using the heat thus absorbed to supply heat to a gas-producer, in order "to maintain the contents of the producer at a sufficient temperature to cause the carbon to continuously decompose steam, and produce an inflammable gas, free, or nearly free, from nitrogen." 2. A gas-producer, comprising (*a*) a producer portion containing incandescent carbon or fuel; (*b*) regenerators alternately heated by the exhaust gases of a gas-engine; (*c*) a steam supply to be decomposed; (*d*) arrangements to allow the gases from the producer to be circulated through the producer and regenerator—preferably pipes lined with non-conducting material, and a steam gas-propelling jet, or other gas-propelling device, such as a pump or fan; and (*e*) a reversing valve and other valve connections. 3. A gas-engine, in which the air and gas supply are separately compressed into chambers; the compressed air being admitted to the power cylinder for a portion of the forward stroke, when the air supply is cut off and the compressed gas is admitted, and caused to be mixed with the air in the cylinder, then ignited by an incandescent surface or other means, and the power stroke so produced.

Atmospheric Gas-Burners.—Moul, H. E.; a communication from R. Langhaus, of Berlin. No. 11,625; June 14, 1895.

This atmospheric gas-burner is specially adapted for use in incandescent gas lighting. As shown by the engraving—a vertical section and transverse sections of the burner—there is a tube A, in which the mixing of the gas and air takes place, formed on the principle of the



injector; its internal diameter, at a point coincident with or immediately above the gas-orifice B, being contracted. Thus the jet of gas induces a relatively large volume of air to enter the mixing chamber. Between this point of contraction and the upper extremity of the burner, the tube gradually expands. In most burners of this class, the gas is burnt over the whole area of the burner-top; whereas the most suitable form of flame is that of a hollow cone. This is formed by a deflector or body C, placed below the burner-top, and adapted to divert the gaseous mixture to the annular chamber of the burner-top. With a view to supplying air to the interior of the hollow flame, and thus intensifying the heat, passages D are provided, which extend through the outer and inner walls of the annular chamber, and serve at the same time to maintain the deflector in a central position. To prevent the flame striking back, the mouth of the burner is fitted with wire-gauze E in the usual manner; the burner being also furnished with steatite rings F.

Retort-Charging Apparatus.—Arrol, W., and Foulis, W., of Glasgow. No. 13,867; July 20, 1895.

This invention forms modifications of, as well as additions to, the retort-charging apparatus described in patents No. 14,440 of 1891 and No. 16,749 of 1893.

In carrying out the present invention, the patentees so construct the machine that it will work automatically—that is to say, after being started to charge a retort the machine will automatically regulate each stroke of the pusher, and stop at the last stroke when the retort has been charged. To effect this, the stopper-shaft employed for regulating the various strokes of the pusher, is so mounted that it is capable of being moved longitudinally to the extent of 3 or 4 inches; so that, when the slipper block on the end of one of the horizontal rams comes against any one of the stops on the shaft, the shaft will be pushed forward to the extent of its travel. The shaft is brought back to its normal position by means of a returning stop arrangement, composed of a collar, ring, or sleeve on the shaft, and an engaging pin or block on the slipper or ram. The longitudinal movement of the stopper-shaft is so as to enable it to automatically reverse the direction of the travel of the pusher. This is effected by means of a slotted sleeve or collar on the shaft engaging with a pivoted pawl-shaped lever, the lower end of which is formed with a double pawl or forked portion. The upper end of the pawl-lever is connected, by means of an adjustable rod-and-crank arrangement, to the spindle of a regulating plug cock or valve, constructed so as to control the movement of a hydraulic piston working in a cylinder, the ram of which is connected to a crank on the lifting and depressing spindle of the frame by means of rods or links. The piston in the cylinder is preferably constructed with a rod or ram of large diameter, so as to enable the piston to be moved backwards and forwards by the inlet pressure of the fluid through the medium of a three-way regulating cock or valve, a stopper-shaft, and their connections.

The patentees further arrange to employ an auxiliary coal receiver or plate, mounted above the main shoot and below the shoot of the hopper. The plate is connected to an operating spindle by means of an arrangement of levers and cranks, detachable from each other when required. The operating spindle is provided with a double-armed trigger arrangement, mounted in such a manner as to be operated in the required direction by the slipper block of one of the horizontal rams; the object being to enable the coal to be delivered in front of the pusher immediately it is at the end of its backward stroke.

In the present arrangement, a double rake or pusher is employed—that is to say, two rake or pusher plates are mounted on the end of the rake or pusher rod, with a space of several inches left between them, so as to enable the rear plate to take with it any material which the front plate has missed.

In order to start the said machine, there is an operating handle or lever on the spindle of the regulating plug cock or valve, so arranged that the operator has only to move the handle when starting to charge a retort; the machine working automatically thereafter, until the last stroke, when the cock or valve is not actuated or opened owing to the slot in the collar of the stopper-shaft allowing the pawl-lever to remain stationary.

In some cases (if desired), the patentees arrange to provide the machine with a coal-elevating device, consisting of a hydraulic swinging crane, suitably mounted on the boggie or carriage of the machine, and provided with either a round or rectangular bucket, or with suitable grab; or the elevating device may consist of an endless band or chain and buckets mounted on the machine, so as to elevate the material and deposit it in the hopper. The elevator is preferably operated by a hydraulic cylinder with rack-and-pinion arrangement, or by a hydraulic motor similar to that described in patent No. 13,400 of 1894.

Gas-Igniting Device.—Jahnsson, J., of Stockholm. No. 14,403; July 29, 1895.

The object of the present invention, which has reference to electrical gas-igniting devices of the kind described in patent No. 3085 of 1895, is to enable the person operating the push-button employed for controlling the igniting device, to be informed whether the gas has been effectually turned on or off, and also whether the coil of platinum wire for lighting the gas has been rendered incandescent. For this purpose, there is an indicator (located within sight of the person operating the push-button), provided with a dial and also with a coil of platinum wire similar to that employed for igniting the gas. The indicator is arranged in circuit with the igniting device, and is adapted to work synchronously with the gas-valve, so that when the push-button is operated, the dial will display the word "open" if the valve be raised, or the word "closed" if it be lowered. The indicator coil will also glow simultaneously with the coil employed for igniting the gas at the burner.

Washing and Scrubbing Gas.—Laycock, J., and Clapham, T., of Keighley. No. 16,139; Aug. 28, 1895.

This is a modification of the now well-known "Eclipse" washer-scrubber; the object of the present invention being to make the apparatus (without adding to the cost of its production) perform its functions more efficiently.

To attain this object, each drum is divided, transversely to its axis, into two distinct portions, which are, as usual, divided by radiating pieces into any desired number of spaces, again subdivided in order to leave space around the central shaft. The usual buckets are arranged on the periphery of the drum, for raising the water and causing it to circulate radially within the drum through the intervening spaces, which are filled with wooden balls or other substances, as is well understood. The dividing walls approaching the axle are perforated, as is also the peripheral rim on which the buckets are mounted; while the transverse partition has openings made through it approaching its outer edge. By forming the drums in this way, and by mounting them so that one of their ends is at a certain part of it in contact with one of the partitions in the chamber in which they are mounted, the gas on passing through them is made to percolate through the interstices between the balls of one chamber, pass thence through the openings in the transverse partition of the drum, and forward through the interstices between the balls in the other chamber of the drum—emerging to pass through the separate chambers of each drum successively.

The series of compartments into which the cylinder containing the drums is divided by its several partitions, are to a certain extent filled with water supplied thereto by flowing in an opposite direction to that in which the gas travels through the apparatus. In order to keep the water at about an even depth in all the compartments, and further to prevent that in the more advanced compartment from flowing back into the preceding one (instead of the overflow merely passing over or through a slot or opening in the partition), a pipe with suitable outlet and other regulating valves or taps is placed to lead from the lower part of one compartment to the upper part of the one following it, in its order; while a check-valve is situated in any suitable part of it or in a closed box having valves on each side of it, to regulate the flow of the water through it when desired; so that by its action the water is at all times prevented from returning, and is constrained to follow its proper course as desired.

Incandescence Gas-Mantles.—Léry, J. B. de, of New York, U.S.A. No. 7429; April 8, 1896.

These mantles are constructed from threads composed of a solution of nitro-cellulose, containing the substances which are intended, upon being exposed to the flame of the lamp to produce incandescence. Such mantles are said to be "more flexible, more resisting in use, and give a superior light effect."

The patentee says he prefers to employ the particular kind of nitro-cellulose that is soluble in crystallizable or concentrated acetic acid, and to dissolve it in that acid or in other organic acids which will also dissolve the nitro-cellulose—such as propionic acid, valeric acid, butyric acid, and the like. The reason why he prefers to employ an acid solvent is that he is hereby enabled to bring into solution the salts or oxides which are ultimately relied upon to produce the incandescence. If, however, it be not considered necessary to bring the salts or oxides into solution, then he would use the ordinary solvents—such as acetone or alcohol-ether. But inasmuch as solution in the organic acid produces a more homogeneous and generally superior result, he prefers to employ such solvent.

He first produces a thick syrup, dough, or jelly, consisting of the dissolved nitro-cellulose, and containing the salts or oxides in solution or suspension. The salts or oxides employed may be those generally used in constructing the mantles, or preferably salts or oxides may be used obtained from monazite sands, and containing the metals and earths of the cerium group, alone or combined with other suitable salts. In carrying out this part of the invention, the patentee takes 100 parts of the nitro-cellulose and dissolves it in 1200 parts of crystallizable or concentrated acetic acid, adding 30 parts of the salts or oxides—the salts being preferably acetates or nitrates. In order that their mixture with the syrup, dough, or jelly may be complete, it is well to dissolve the salts or oxides previously in a small quantity of water or the acid. The syrup, dough, or jelly free from gritty and unsuitable foreign substances, is then squirted through capillary tubes or small orifices, producing fine threads, which are repeatedly washed to deprive them of their free acetic acid or other solvent. By preference, they are, on leaving the capillary tubes or orifices, treated with an alkaline solution, or with a solution of an alkaline sulphide, in order to transform the salts and oxides into insoluble substances, which thus remain fixed or "imprisoned" in the artificial thread. The threads which result from this operation can serve directly in the manufacture of the mantle; but it is preferred first to denitrify them.

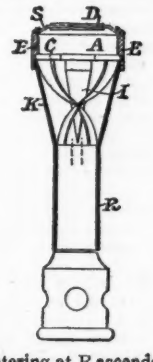
The denitrification can be carried out by any of the known processes for the denitrification of nitro-cellulose, but with the condition of operating in a neutral solution—by preference, alkali. For this purpose, the patentee makes use of sulphuretted hydrogen or an alkaline solution such as that of sulpho-hydrate of ammonium; but he claims to be able to succeed equally with sulpho-hydrate of sodium, zinc, or zinc in the presence of an alkali.

After denitrification, the threads are subjected to numerous washings in clear water; and they are then utilized in the manufacture of mantles of the desired form and dimensions by weaving, knitting, or braiding, as at present.

Incandescent Gas Lighting Burner.—Ernst, E., of Friedenau, Germany. No. 8149; April 17, 1896.

This invention relates to a regulating device for incandescent gas-burners, to obtain a proper mixing of the gas and air introduced.

The gas issuing from the supply-pipe sucks in air in the ordinary way; the air gaining, on its way through the tube R, the same speed as the gas. As the mixture is heated, the gases expand—necessitating a corresponding enlargement of the tube. The next mixing chamber, therefore, receives a conical shape; allowing sufficient room for a cone I suspended to a cross-pin (not shown), and forming a circular passage for the mixture. The top of the burner A has a cylindrical form; the cylinder E being smooth inside as well as out. The top is entirely open inside, and is enlarged opposite the conical



part of K. The mixture entering at R ascends to the top of the burner, which is covered with wire gauze S, and is provided with a flame-divider D. To ensure, however, the uniformity of the mixture, there is arranged in the cone K—that is, in the part in which the mixture would be acted upon—a mixing-device so as neither to choke the burner

nor retain particles of dust, while it can be readily cleaned when needed by blowing through it. Concentric spirals are arranged one within the other; the inner one having left-handed and the outer one right-handed convolutions, or *vice versâ*. The ascending inner current of gas is thus caused "to twirl in a left sense, while the likewise ascending outer current of air is caused to twirl to the right." Thus thorough intermixing of the gas and air takes place.

Producing Illuminating Gas.—Gautzsch, C., of Münster, Germany. No. 8239; April 18, 1896.

This invention relates to the production of illuminating gas from unheated atmospheric air and liquid hydrocarbons. The apparatus for the purpose consists of an air-pump (preferably worked by hand), a collecting vessel for high-pressure air, a collecting vessel for low pressure air, and a receptacle for liquid hydrocarbon. In the former, the compressed air is accumulated; and thence, according to requirement, part of it is passed through the pipe conduit and valve into the low-pressure air-vessel. From this vessel, the compressed air is passed into a vessel filled with a hydrocarbon liquid. The air is forced into and through the liquid by way of numerous fine openings provided in a tube arranged near the bottom of the vessel. Thence the air, charged with volatile substances absorbed from the liquid hydrocarbon, passes to the burners.

Lamp-Burners.—Deimel, F., of Berlin. No. 9128; April 30, 1896.

This lamp-burner, for use with an incandescent mantle, consists of a conical frustrum, having lateral slits or openings, and closed at the upper end by a disc, preferably projecting beyond the burner-head; while the tapered mixing chamber is surrounded by spring plates, or by a divided cylindrical shield, the lower part of which is enlarged. It has air-inlets, and is provided with external means whereby the plates or shield can be closed together, so as to cause air to penetrate to the burner-head and interior of the incandescence body; while the latter is at the same time brought to a central position thereby.

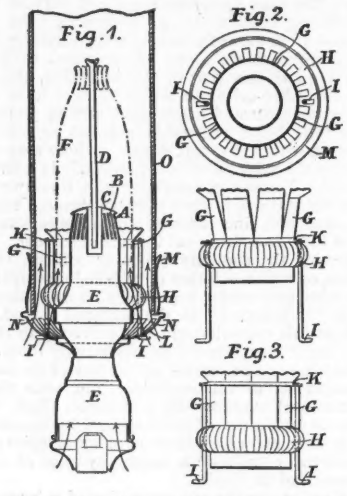


Fig. 1 is a longitudinal section, and fig. 2 a cross section of the burner; fig. 3 shows the device for centering the mantle from the outside, and for the admission of air to the burner-head, both in the open and closed positions.

The burner-head A consists of a conical frustrum having slotted openings B, and closed at the top by a disc C, which supports the mantle-carrier D in the known manner. This, for reasons to be presently stated, projects slightly beyond the upper end of the cone. The diameter of the burner-head is considerably smaller than that of the mixing chamber E and of the base of the mantle F, in order that, within the mixing chamber, by means of the greater width of this, followed by the restriction of the burner-head, a perfect mixing of the air supply and gas is effected, while the bottom of the mantle is not, as heretofore, brought in contact with the burner-head. At the same time, the arrangement for centering the mantle from the outside, and for supplying air to the interior of the mantle, is said "to maintain the symmetrical form of the mantle permanently during use."

The upper part of the mixing chamber is surrounded to about the height of the base of the burner-head by plates G, having an outward spring action. They are enlarged at the lower part, forming a projecting bead, and are there provided with air-inlets H. A ring K, provided with handles I, embraces the plates in such manner that (when it is pushed upward) it presses the plates together so as to form a cylinder, which causes the air entering through the slits H to be led to the interior of the mantle, and consequently to the burner-head, and at the same time serves to bring the mantle into a central position.

The construction of the burner-head A, as a conical frustrum having air slits, causes the mixture of gas and air flowing through the mixing chamber E, and pressed somewhat together in the upper part, to have a tendency to spread outward and upward against the inner surface of the mantle on issuing from the slits, which tendency is increased if the disc C covering the burner-head projects with its rim slightly beyond the latter.

The burner is closed at the bottom by a cage L, which carries the gallery M for the chimney O, and is provided with air-openings N. When the chimney has been inserted in its gallery, the air supply for combustion can only enter from below through the bottom of the burner cage through the air-holes N. The body of air entering at the bottom of the glass divides in rising—one portion passing through the slits H to the burner-head and interior of the mantle, while the other part passes directly up the chimney in contact with the outer surface of the mantle.

Gas-Heating Apparatus.—Fletcher, T., Russell, W., and Fletcher, Russell, and Co., Limited, of Warrington. No. 9182; May 1, 1896.

This invention refers primarily to gas-heated irons; the arrangement being such that, when the iron is to be withdrawn for use, the door of the stove must be opened. At the same time the gas is lowered, and remains lowered so long as the door is open. After the iron is replaced, the door is again closed; and the gas supply is then automatically increased. The means for increasing and reducing the gas supply by the movement of the hinged door, consists essentially of a plug-cock on the gas-supply branch, a bifurcated lever attached to the plug of the cock, and an arm or projection from the door capable of engaging with the lever and moving it in either direction.

APPLICATIONS FOR LETTERS PATENT.

14,332.—Adamson, A. G., "Use of electric light, gas, or oil for photographic, illuminating, and other purposes." June 29.

14,365.—Killing, C., "Incandescence bodies for incandescent gas lighting." June 29.

14,405.—Woolidge, W. W., "Gas and the like engines." June 30.

14,448.—Caro, N., and Saulmann, W., "Incandescing bodies, or mantles, for lighting purposes." June 30.

14,456.—Boult, A. J., "Incandescent gas-light burners." A communication from La Compagnie d'Installation pour l'Eclairage et le Chauffage par le Gaz. June 30.

14,471.—Jones, H. S., "Tap for controlling the flow of liquids or gases through two or more conduits." A communication from A. Vosmaer. June 30.

14,505.—Grosch, R., "Gas-lamps." June 30.

14,580.—Jones, H. S., "Gas-burner for incandescence lighting." A communication from Willing and Violet. July 1.

14,641.—Byng, G., "Electric gas lighters." July 2.

14,740.—Cannell-Bunn, P., "Mantles for gas and other burners." July 3.

14,808.—Lewis, E. E., "Gas stands for the heating of smoothing-irons for laundry and other purposes." July 4.

14,845.—Langhans, R., "Incandescing media for use in incandescent gas lighting." July 4.

14,858.—Dennett, T. L., "Incandescent gas and oil burners." July 4.

14,877.—Winstanley, G., "Fastening the lids of retort mouthpieces and other self-sealing lids and doors." July 4.

CORRESPONDENCE.

[We are not responsible for the opinions expressed by correspondents.]

Tunnelled Retort-Benches.

Sir,—I have read with interest your article on the above subject, in the current number of the "Journal;" and while it is not my intention to discuss the matter (either from its patentability, its technical, or from its practical point of view), I would like to point out that an identically similar system has been working in Huddersfield for the past five years.

I send two diagrams showing the arrangement of the furnace, from which it will be seen that the clinkering doors are face to face, and the

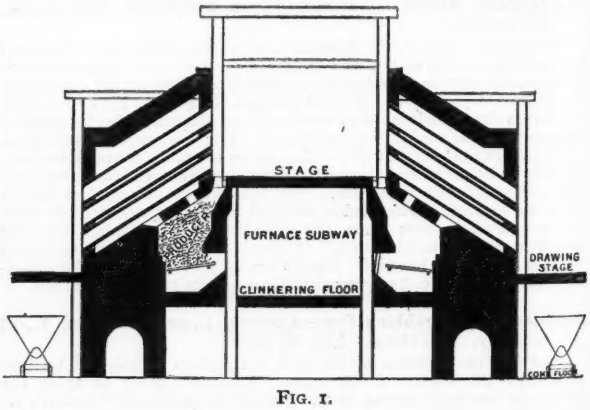


Fig. 1.

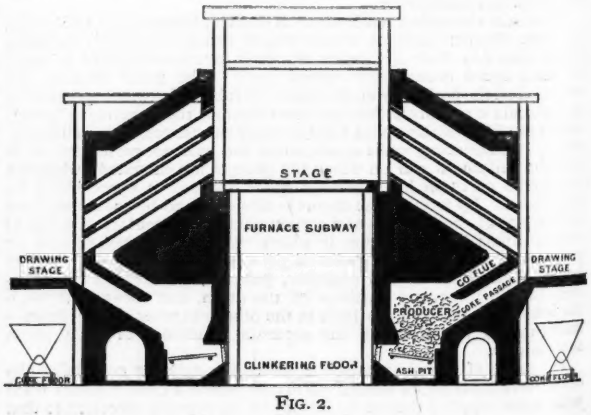


Fig. 2.

whole of the dampers and air-ports are retained within the tunnel or subway between the retort-benches, thus leaving the front or drawing side absolutely clear for coke purposes.

Fig. 1 shows the arrangement as it was originally put in, and fig. 2 shows a modified arrangement, now being put in, whereby the producers are fed with hot coke from the front of the settings, the clinkering doors thus being still retained within the subway.

I think it wise that these facts should be placed on record, to prevent any misunderstanding in the future.

W. R. HERRING.

Huddersfield, July 9, 1896.

SIR,—The arrangement shown in fig. 2 in the article under the above heading in your last issue, is an exact counterpart of one put in by me at these works in the year 1881, and still in existence. In 1883, the entire bench was converted from ordinary to generator furnaces, and the whole underpinned without disturbing either the bench or the retort-settings, and without any apparent subsidence.

I had not the advantage to start with that Mr. Joyce has. He has, it appears, an underground main flue to commence with, which I had not.

J. R. FRITH.

Gas-Works, Runcorn, July 8, 1896.

The Estimation of Nitrogen in Coal Gas.

SIR,—It would appear from Mr. Wright's last letter, that he is still sceptical as to the accuracy of coal gas analyses showing high percentages of nitrogen; and he concludes that it is not necessary to further discuss this question, upon which there can be little doubt. The matter may therefore rest; as I have already given my views—viz., that nitrogen can be accurately estimated in coal gas, and that coal gas of high illuminating power has frequently been found, both by myself and others, containing a very considerable percentage of nitrogen. To those of your readers, however, who do not feel quite so sure about the matter as Mr. Wright does, I would recommend the perusal of Professor Foster's paper,* in which contrary opinions to those of Mr. Wright are put forward. At the same time, I do not wish to be credited with a belief, which I have never expressed, that such analyses are representative; for though not doubting their accuracy, I regard them as exceptional.

Against my opinion that "it is doubtful whether in coal gas any but traces of nitrogen are derived from the coal itself," Mr. Wright adduces the *belief* of several investigators that that portion of the nitrogen of the coal which they were unable to find in the coke, liquor, and cyanogen, may have been in the gas in the free state. Guéguen, whose essay on the "Chemical Theory of the Production of Illuminating Gas†" will be remembered, found, however, that the whole of the nitrogen of the coal was present in the bye-products alone; while the late Professor Heaton, who in 1889 made a very complete investigation (at which I assisted) of the distribution of the nitrogen of a coal among the products when distilled at varying temperatures, likewise found that in every case the whole of the nitrogen was present in the bye-products. It was consequently assumed that there could have been none of it in the gas. Such investigations, therefore, do not always support the belief that considerable quantities of the nitrogen of a coal—sufficient, however, in no case to amount to more than 2 per cent. by volume of the gas made—pass in the free state into the gas.

I have attacked the subject in a different manner. From a number of analyses, extending over several years, I have found that the greater the precautions taken in excluding air, the less has been the quantity of nitrogen in the gas, until, with clay retorts working under a little pressure, gas has been obtained in which no nitrogen could be found. I note that some of Mr. Wright's experiments upon the distribution of nitrogen have been made with clay retorts, but assumed that those given on p. 187 of "Thorpe's Dictionary" were the ones to which Mr. Wright drew attention in his previous letter. With clay retorts, worked under a little exhaust, or even at level gauge, the presence of nitrogen in the gas made cannot be regarded as conclusive evidence that coal upon distillation yields any of its nitrogen in the free state.

E. LLEWELLYN PRYCE.

Adderley Street Gas-Works, Birmingham, July 10, 1896.

Reduction in Price.—The price of gas at West Cowes has been reduced by 1d. per 1000 feet (4s. to 3s. 11d.) as from the 1st inst.

Contemplated Extension of the Limits of the Water Supply of Newark.—With the view of defending their source of supply, the Newark District Council have determined to give notice to the Nottingham Corporation and the Southwell District Council of their intention to promote a Bill in Parliament authorizing them to extend their limits of supply, so as to include the parishes of Oxton and Epperstone.

New Water-Works for Daventry.—Mr. John Eunson and the Borough Surveyor (Mr. J. B. Williams) have laid before the Daventry Town Council a scheme for a new water supply for the town. Borings in a field in the neighbourhood have revealed an abundant supply of water of a high degree of purity; and the total outlay for complete works for utilizing this supply is estimated at £5200. The Town Council have not yet arrived at a decision upon the subject.

New Water-Works for Middlewich.—The town of Middlewich was *en fête* last Wednesday week; the occasion being the formal opening of the new water-works, which have been constructed at a cost of £12,000 from plans prepared by Mr. R. T. Worth. Business was entirely suspended; and the streets were profusely decorated with bunting, mottoes, and a great variety of devices. There was a public procession to the Warcroft, where Mr. W. Boosey, J.P., Chairman of the District Council, touched an electric button which caused water from the new works (which are about 2 miles away) to flow freely through an artistic fountain. The appearance of the water was greeted with loud cheering. The day's programme embraced a public lunch; and at night the town was brilliantly illuminated.

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* See "JOURNAL," Vol. LIX., p. 1174.
† *Ibid.*, Vol. XLIV., p. 1174.

PARLIAMENTARY INTELLIGENCE.

HOUSE OF LORDS.

Monday, July 6.

METROPOLITAN COUNTIES WATER BOARD BILL.

On the third reading of this Bill,

The Earl of DENBIGH moved, as an amendment to clause 2, that there should be four instead of two members of the Water Board appointed by the Common Council of the City of London.

Lord JAMES OF HEREFORD said he was sorry he could not accept the amendment, as it would involve a re-adjustment which he was unable to make, and the two Conservancy Boards had expressed indignation at the proposal.

The amendment was withdrawn.

The Earl of DENBIGH moved an alternative amendment adding to the members of the Water Board the Chamberlain of the City of London as Trustee of the sinking fund applicable to portions of the capitals of the Metropolitan Water Companies. The Corporation had, he said, secured a sinking fund out of the profits arising on the borrowed moneys of the Companies for the purpose of paying a portion of the purchase-money when the Companies came to be bought out. It now amounted to £2,890,000, and would eventually reach £3,800,000.

Lord JAMES OF HEREFORD regretted that he was unable to accept the amendment, as it would entirely upset the scheme of the Bill, which was to establish a body upon which there was to be no official representative.

The amendment was withdrawn.

Lord JAMES OF HEREFORD moved an amendment to clause 5, empowering a County Council to determine whether the expenses of opposing the Bill should be defrayed by the county generally or by the parishes at present supplied with water by the Companies.

The amendment was agreed to.

The Earl of DENBIGH moved to omit sub-section (*d*) in clause 7, which provides that the county councillors elected for the City of London shall not vote in the appointment of members by the London County Council. This was, he said, another humble attempt on his part to obtain exceptional treatment in favour of the Corporation.

Lord JAMES OF HEREFORD said that, unfortunately, the amendment of the noble Earl had only just been circulated; and, in the circumstances, he had better communicate on the subject with those who would be in charge of the Bill in the House of Commons, when his amendment would probably be favourably received.

The Earl of ROSEBERY said he would avail himself of this opportunity to ask whether it was really intended to proceed with the Bill in the other House of Parliament.

Lord JAMES OF HEREFORD said it would be proceeded with unless it was opposed. The Bill had been framed with the object of meeting the views of all parties interested; and he hoped it would be allowed to pass without opposition.

The amendment was withdrawn.

After some further conversation, the Bill was passed.

The following progress was made with Bills last week:—

Bills brought from the Commons, read the first time, and referred to the Examiners: New River Company Bill, Staines Reservoirs Bill.

Bills read a second time and committed: Bilston Improvement Bill, Kilmarnock Corporation Water Bill.

Bills reported with amendments: Edinburgh Extension Bill, South Metropolitan Gas Bill.

Bills read the third time and passed: Kelty Water Provisional Order Bill, London Sea Water Supply Bill, Metropolitan Counties Water Board Bill, Yeovil Corporation Water Bill.

HOUSE OF COMMONS.

The following progress was made with Bills last week:—

Bills read a second time and committed: Dublin Corporation Bill, Redheugh Bridge Bill.

Bills reported: Barry Urban District Council Bill, Culter Water Order Confirmation Bill, Southwark and Vauxhall Water Bill [preamble not proved].

Bills reported, with amendments: Aldershot Gas and Water Bill, New River Company Bill.

Bills read the third time and passed: Culter Water Order Confirmation Bill, Drogheda Corporation Bill, New River Company Bill, Staines Reservoirs Bill.

HOUSE OF COMMONS COMMITTEE ON THE LONDON WATER BILLS.

Tuesday, June 23.

(*Before Sir* J. PEASE, *Chairman; Sir* J. BRUNNER, *Mr.* BALDWIN, *Mr.* BOND, *Mr.* J. STUART, *Mr.* BRIGG, *Mr.* FRY, *Mr.* LEES KNOWLES, *and Mr.* MUNTZ.)

NEW RIVER COMPANY BILL.

This Bill, which is to confer further powers upon the New River Company for the execution of auxiliary works, the purchase of additional lands, and the raising of further money, came under consideration to-day.

Mr. POPE, Q.C., Mr. LITTLER, Q.C., Mr. PEMBER, Q.C., and Mr. CLAUDE BAGGALLAY appeared for the promoters. The following were the petitioners against the Bill: The London County Council, represented by Mr. BALFOUR BROWNE, Q.C., Mr. WORSLEY TAYLOR, Q.C., Mr. FREEMAN, Q.C., and Mr. KEMP; the Middlesex County Council,

by Lord R. CECIL, who also appeared for Earl Cowper, the Corporation of Hertford, the Marquis Townshend, Captain Parker's Trustees, and the Marquis of Salisbury; the London and Middlesex Freehold Estates Company, Limited, represented by Mr. CLODE; Mr. G. Pearson, by Mr. SHIRESS WILL, Q.C., and Sir G. W. MORRISON; the Corporation of London, by Sir W. MARRIOTT and Mr. P. HENRIQUES; Messrs. Pratt and Co., represented by Mr. FORBES LANKESTER; the Urban District Council of Enfield, by Mr. E. POLLOCK, Q.C.; the Hertfordshire County Council, by Mr. WALTON, Q.C., and Lord R. CECIL; and several other petitioners, by the Hon. S. HOLLAND. Petitions had been presented by H. J. S. Bosanquet, the Broxbourne Parish Council, the Southgate Urban District Council, Eliza Sharpe, the Great Eastern Railway Company, and Rosa and Henry Rayner; but their Counsel were reserved.

Mr. POPE, in opening the case for the promoters, said the number of appearances against the Bill showed it was likely to involve a good deal of discussion. At the same time, the petitions mostly related to matters which were of ordinary inquiry in all Water Companies' Bills—as, for instance, the assertion upon the part of the petitioners that the proposed increase in the number of wells might be injurious to their existing water supply. They were questions of fact, which were peculiar to each particular case. The petition of the London County Council involved questions such as those which had already been discussed before the Committee. The first point the Committee would have to decide would be the urgency of the need for water, and how far they could give effect to the Bill under the instructions they had received from the House. The Bill was prepared before the Instruction of thes House; and it was intended, in conjunction with the Staines Reservoirs Bill, to provide for the wants of the Company during the ordinary period in which Water Bills contemplated the future. The Bill, however, contained no more than would be necessary if the Staines Reservoirs Bill was not proceeded with; and it would provide for wants which were not covered by the other measure. For instance, the Company asked, among other things, for additional capital powers in the Bill; these being necessary by reason of the fact that they had already the working capital of the concern appropriated to the laying of mains, which must go on year after year. The Bill proposed a new subsiding reservoir and filter-beds at Wood Green; and these, practically, were the contested works. As the Company's existing storage did not exceed a day-and-a-half's supply, it was also proposed to construct a reservoir at Enfield Chase. It was intended to open up six new wells—three within the present parliamentary district of supply, and three outside. Learned Counsel then went through the petitions against the Bill. In regard to those of the landowners, he said that, if they were before a legal tribunal, it might be desirable to apply for an order to consolidate some of the oppositions; for, in truth, the petitions, one after the other, though representing different interests, raised exactly the same point. One would have thought the petitioners might have combined to reduce the extent of the inquiry. The capital powers of the Bill were £1,500,000. The amount of special estimates for works came to £1,227,722, which left a margin, because in the estimate there was nothing provided for such necessities as pipe and main laying, and the various yearly requirements.

Before evidence was called, the Committee requested that the room should be cleared. They remained in private deliberation for a quarter of an hour; and on the re-admission of the public,

The CHAIRMAN said: The Committee have felt themselves in a difficulty, because, in our decision on the Staines Reservoirs Bill, we have, after hearing the evidence of the New River Company, endeavoured to provide water for them. If that Bill goes forward, this question will be very much simplified, as we shall not then have to go into the question of water supply. Therefore, it seems to me that we have no alternative but to adjourn the further consideration of this Bill until we know the decision of the parties on Friday to go on with the Staines Reservoirs Bill. I am sorry to say we have dismissed all the parties concerned in the Southwark and Vauxhall Bill; and therefore we cannot proceed with that.

Mr. POPE said considerations of time rendered it desirable that progress should be made with the New River Bill as soon as possible.

The CHAIRMAN remarked that probably time would be saved by taking evidence as to the internal economy of the Company—their wants with respect to the supply of their customers.

This suggestion was adopted; the understanding being that witnesses should merely supplement the evidence given by them on the Staines Reservoirs Bill for the information of the Committee; but that they should not be subjected to cross-examination until Friday, when it would be known what course the Company proposed to take in regard to the Staines Bill.

Mr. *J. Francis*, M.Inst.C.E., Engineer to the New River Company, and Joint Engineer with Mr. Middleton to the scheme before the Committee, was then called. Examined by Mr. PEMBER, he pointed out the position of the existing thirteen wells of the Company, and declared that the total amount of water available for their daily supply was 46,830,000 gallons. From the existing wells, the Company could rely, after allowing for ordinary stoppages and casualties to the wells or machinery, upon 24 million gallons continuously. If the machinery and wells would always hold out, he could get the 34 million gallons he had mentioned to the Royal Commission. He thought that 2 or 3 million gallons more could be obtained from the existing wells, by improving some of the machinery and making further borings or tunnels. They were at present constructing a new well under the old powers.

Mr. PEMBER: Suppose you could increase your supply with improved machinery by 2 million gallons a day, would that meet your requirements?

Witness: No; it would not. Assuming the rate of increase in the future to be the same as it has been during the past four years, in fifteen years the daily supply would be 58½ million gallons. In ten years it would be 52 million gallons.

But besides that, I believe, you think that provision has to be made for the maximum demand which is likely to arise?—That is an absolute necessity; and this maximum must be taken at 25 per cent. beyond the average for the year, so that in twenty years from the present time the maximum supply required throughout the year would be 79 million gallons.

The CHAIRMAN remarked that they had better keep clear of the twenty years.

Witness (continuing) said that within fifteen years the deficiency to be made up would be 26 million gallons; and within ten years, 18 million gallons. In giving these figures, he had not taken the 35 gallons per head per day in the report of the Royal Commission. He had worked from the supply the Company were actually now giving; believing it to be a more reliable basis. During the four years ending 1887, the average daily supply was increased by more than 404,000 gallons. In the four years ending 1891, it was 759,000 gallons per day; and in the years ending 1895, it rose still higher. The ratio of increase seemed therefore to go on advancing every four years. The New River Company in the past had adopted well-sinking as a means of increasing their supply. They had been able to obtain excellent water more easily than they could store the water of the River Lea; and they had also to bear in mind that the more water they took from the Lea, the more they would be reducing the quantity available for the East London Company. In order to meet the necessity which he suggested was coming upon them in the future, they proposed to make six new wells in the chalk, with pumping-stations and lines of main to the channel of the New River. He estimated that these wells would yield 10 million gallons of water per day. It was proposed to take 8 acres of land at Mardock, 17 acres at West Mill, 5½ acres at Stapleford, 10 acres at Tewin, 11 acres at Essendon, and 8½ acres at Blakefield—or 60 acres altogether. The neighbourhoods of the proposed well sites were all very sparsely populated. For the storage reservoir at Enfield Chase, a total area of 370 acres of land would be taken; the reservoir having a capacity of 867 million gallons. It would be filled by pumping from the New River at Highfield, Edmonton, water which had been drawn from the River Lea or from wells. It would give a daily quantity of 15 million gallons for a period of 57 days for the supply of the Company's district; and it would be of special value in case of sudden increase of consumption. The proposed subsiding reservoir at Highfield would occupy 28 acres of land, and would have a capacity of 140 million gallons of water. It was proposed to enlarge the existing subsiding reservoir at Wood Green, to a capacity of about 60 million gallons; and new filter-beds were to be made at Stoke Newington. There was also to be an enlargement of a covered surface reservoir at Hampstead Heath, and of the channel of the New River itself. When all the works now in contemplation were completed, the supply of water would be 22,500,000 gallons from the River Lea, 330,000 gallons from ponds, 38,000,000 gallons from springs and wells. This would not include any water from the Thames. Besides requiring capital for these works, money was needed for other purposes—such as the completion of the wells at Whitewebbs. The estimate of expenditure amounted to £1,596,102.

Mr. PEMBER: Do you think that the pumping from the chalk which has taken place during the last twenty years has caused any depletion of the water in it?

Witness: The pumping from the bare chalk area to the north of London has not depleted that chalk. The pumping from under London itself has depleted the London basin; but outside there has been no depletion whatever. The Company have merely taken water that would have otherwise passed on underground; and the best proof of what I say is that the rest levels in the Companies' wells, where they are out in the bare chalk, have not permanently lowered at all—they are as high now as ever they were. There are constant slight variations of the levels, arising from alterations of the wet and dry seasons of the year; but the original level is always regained.

Mr. JAMES STUART: Does it come to this, that it is like pumping out of the sea—that is to say, you have an immense quantity of water?

Witness: That is it; or rather out of an underground river. We consider that as fast as we pump it out, other water is coming down to replace what is taken. It was pointed out just now that the discharge of the River Lea showed that no effect had been produced upon the river by our pumping. I would make the same remark in regard to the Chadwell spring. There is no diminution of the whole of the yield of that spring; it simply varies, as it always has done, with the wet and dry seasons.

Mr. PEMBER: Now might the question of the surface and of the strata immediately underneath the surface, taken together, operate to cause a temporary depletion in the chalk?

Witness: The question with regard to the large quantity of water just mentioned is, where does it come from? It is, of course, rain water; and the quantity that gets into the ground to form this extensive underground river depends upon the ease with which it percolates downwards. There is, I believe, nowhere any soil except sand so pervious to water; and the whole of the gathering ground of these wells is either chalk or chalk covered with permeable gravels. If there is clay on the top, the water is retained on the surface for some little time, and there is some evaporation. But when the chalk itself is covered only with a few inches, or possibly a foot or two, of soil, there is no opportunity of evaporation, and we get a very large proportion of the rainfall. This, however, bears rather upon the amount there is to pump, than upon the question of the depletion of the chalk. It is a well-known fact that the bed of a river draining a chalk district is very much smaller than the channel of a river draining a clay district of the same area; and this shows that the stream of the one is little swollen by a heavy rainfall, whereas that of the other is very rapidly increased. A further point is the small sectional area of the waterway of bridges on chalk, as compared with what is necessary in a clay district. On the Upper Lea and its tributaries, the small size of the channels under the bridges is very noticeable indeed.

In answer to further questions, witness stated that the Company did not desire to enclose any lammas or common land in Hertfordshire. Their only desire was to lay a pipe across those commons underground, and to have a right over only (say) 16 or 20 feet, except where absolutely necessary to have a greater width for wells and apparatus.

Monday, June 29.

The proceedings on the Bill, which were postponed in order that the decision of the Committee on the Staines Reservoirs Bill might be considered by the parties interested, were resumed to-day.

The CHAIRMAN said that when they closed their sitting on the previous Friday,* they had what he might call rather a desultory conversation with Mr. Pope as to the things which could be eliminated from the New River Bill. Thinking it over from that time to the present moment, it had struck him that there might be certain points which the London County Council would not be disposed to say a word against. There were other things, of course, to which they would naturally object as, in their opinion, going beyond the instruction which had been given by the House to the Committee. He had been wondering whether learned Counsel would not save themselves and the Committee a good deal of time if a further elimination could take place, and those things could be agreed upon to go forward which all parties considered to be absolutely necessary. They then confined themselves to the fewer matters which would be left in dispute. He said this without giving the slightest opinion at the present moment as to the view of the Committee upon any of these items.

Mr. BALFOUR BROWNE said that, as representing the London County Council, without pledging themselves that there were things in the Bill to which they would be willing to agree, it did seem important that the desultory conversation to which the Chairman referred should have its effect upon the filling up of the Bill. He had not yet seen the Bill the New River Company were now proposing. He had heard what had been said, and, of course, the original Bill would be largely modified by what Mr. Pope had suggested; but he (Mr. Balfour Browne) would not be in a position to express an opinion upon what remained in the Bill until he saw finally what his learned friends were proposing. The estimate which remained contained a large number of items which had already been abandoned by the Company. Until he had had an opportunity of knowing what they were now proposing, he should not like to take the responsibility of doing anything in the matter. What he would suggest was that so far as the London County Council were concerned they should not be asked to cross-examine witnesses to-day. As the Bill before the Committee was to a large extent a new measure, and he had received instructions from the County Council as to how to deal with it, he should prefer to have an opportunity of consulting them.

Mr. LITTLER said the promoters proposed to call Mr. Francis, the Engineer to the Company, and to get him to go through the Bill item by item, referring to those things which had been struck out. He would say what part of the estimate related to each particular item. The portions to be dropped would then be eliminated from the Bill. If his learned friend (Mr. Balfour Browne) had expressed willingness for the Bill to pass in some shape or other, or for the preamble to be postponed on the understanding that there would eventually be a preamble, and that the points of contention would be merely the clauses, there would have been something in the learned Counsel's proposal. Otherwise it would merely bring about delay, without helping the Committee in the slightest degree. What he would ask his learned friend was if he would let the Bill proceed so far as the preamble was concerned; leaving that to be amended later on according to the decision of the Committee upon any point which they might think important.

The CHAIRMAN said that, without committing himself to an opinion at the present moment, he might say that any Committee considering such a Bill as the one before them would probably regard the expenditure on pipes and the overdrawn account as necessary. Nor, he should think, would there be much question as to a fair amount of capital being placed in the hands of the Company to continue the mains required for water supply. When, however, they came to the largest item of all—£305,000 for the Enfield Chase reservoir—it struck him that the promoters of the Bill would have some difficulty in proving that it was required, having regard to the instruction given to the Committee, and to the large amount of accommodation which had already been granted to the Company in connection with the Staines reservoirs. If they were to take out the Enfield reservoir, other works would naturally follow, he supposed.

Mr. BALFOUR BROWNE said that, in regard to the two items to which the Chairman had referred—or, at any rate, as to the overdrawn account, amounting to £78,000, he could not accept it without submitting the proposal to a little sifting.

Mr. LITTLER said, as to the £78,000 his learned friend referred to, it was the amount which had been before the Government Auditor

Mr. *Francis* was then re-called, and examined. He showed that the proposed works which the Company would be prepared to abandon in consequence of the passing of the Staines Reservoirs Bill included the Mardock, West Mill Farm, Stapleford, Lewin, Essendon, and Blakefield wells. The Company would not require the aqueduct from the Mardock well. They did not, however, strike out the Enfield Chase reservoir; and they maintained the aqueducts in connection with it. The Highfield subsiding reservoir and the filter-beds were struck out; but it was proposed to retain the pumping-station there for sending water up to the Enfield Chase reservoir, and also to provide an additional engine for pumping to one of the service reservoirs. The enlargement of the existing reservoir at Wood Green would remain; but the filter-beds at Stoke Newington were struck out. The enlargement of another existing reservoir, and the extensions at the Hampstead Heath reservoir, would also remain. He went on to say that he had prepared an estimate of the capital which would still be required for carrying out the works. As he had said, it would be necessary to retain the Enfield Chase storage reservoir, including the main and pipe-laying track and the land; and the estimated cost of these would be £305,000. The aggregate expenditure under the Bill as re-drawn would be £937,347, against £1,500,000 as originally set forth.

Mr. STUART: That is a sum practically equal to the whole of the amount involved in the Staines Reservoirs Bill.

Witness: Yes.

The CHAIRMAN: How long would it take you to construct the Enfield Chase reservoir?

Witness: About two years.

The CHAIRMAN said he did not wish to prejudice the case of the Company; but the bent of his mind certainly was that the Committee would be going beyond their instructions in allowing this reservoir. Those instructions were very strong. They laid down that the Committee were not to allow any items which were not proved to their satisfaction to be works which could not be postponed. The proposed Enfield Chase reservoir was a work which had been proposed for a long time; therefore it could not be said that there was any urgent necessity for it. Besides, the Staines Reservoirs Bill would give the Company more storage water than the well water they would have got if they had secured all the new wells they originally asked for.

Witness stated that the proposed reservoir would enable the Company to keep the water in the river channel level; the channel being 26 miles long. At present they could not keep the level from going up and down; and this led to great waste of water.

Mr. STUART said the proposed new reservoir would be a very desirable thing in itself; but he imagined that the instructions the Committee had received would prevent them from granting it, even if they were so disposed. They had already given the Company, in the Staines measure, a larger amount of storage than the Bill proposed.

Witness: But we shall not get the Staines reservoirs for six or seven years. In the meantime, what are we to do?

The CHAIRMAN: You have, on the average of the year, a very large surplus.

Witness: But we have to provide for the maximum demand. We ought to be able to cope with any sudden demand for fires, and so forth. For some time past, we have been finding it more and more difficult to meet sudden calls upon our resources.

Mr. JOSEPH WALTON, representing the Hertfordshire County Council, cross-examined witness with a view to show the undesirability of giving the Company parliamentary powers to take more water and to drain the district. Witness, however, denied that the millowners and people with wells in the county would be injured by the powers which would be exercised under the Bill. He had made most careful calculations, and found that in very few cases was there any effect at all produced upon their neighbours by the pumping operations of the Company. Where there was any effect at all, it was of a very trifling character.

The CHAIRMAN asked if there was any useful object to be gained in pursuing this line of cross-examination. All the new wells originally proposed in the Bill had been abandoned.

Mr. WALTON pointed out that the Company were asking for parliamentary recognition of increased pumping operations. He desired to resist any increased pumping from the chalk.

The CHAIRMAN said the Company did not pump under statutory powers, but as owners of the land. How could the County Council prevent the Company from pumping?

Mr. WALTON said that, by their pumping operations, the Company were drying up the River Lea. He submitted that there is no legal right to do this.

The CHAIRMAN: The legal right is not for us to determine. If you have a legal right to stop the pumping, do so.

Mr. WALTON: The Company are asking parliamentary sanction to the pumping of more water from the chalk.

Mr. STUART: They are only asking for money to do that which they have a perfect right to do.

The CHAIRMAN: The witness admits that the Company are drawing water from the County of Hertford; and it is for the Committee to say whether that is an improper thing to do, or not.

Sir J. BRUNNER: Mr. Walton puts before us a point that does not arise in ordinary cases. He says the more water the Company pump from the chalk, the less there is in the river; and they are thus destroying the right the county has to take water from the river.

Mr. WALTON: That is so. (To witness:) You admit that?

Witness: Certainly not. I have here a diagram showing the flow of the River Lea since 1858; and it shows that nothing of the kind has taken place. The chalk area is one which absorbs the water almost at once; and it is from the water so absorbed that we are taking the supply in our deep wells. Streams in the chalk are very shallow.

Is it not the fact that in the chalk area you have furrows through which the rivers run; and that the water in the furrows is not derived from the surface overflow, but from the water that comes out of the chalk?—Yes; in the form of springs.

The water in the chalk and in the river are connected, are they not?—No; they are disconnected. The channels in the chalk are self-puddled; and the water does not flow from them into the river.

Do you suggest that pumping in the chalk alongside the river does not affect the water in the river?—None of our wells affect the water in the river.

Mr. WALTON: That is a matter of fact on which we join issue. I propose to prove, if the opportunity is allowed me, that the river has been affected by the pumping.

Cross-examined by Sir W. MARRIOTT, on behalf of the Corporation of London, witness said the Bill contemplated the acquisition of a portion of land which had been dedicated to the public for sport and recreation—namely, Alexandra Park.

Sir W. MARRIOTT: Why do you not use the land you have already in your possession at Wood Green?

Witness: We have used all the land that is suitable for works.

Why is not the land adjoining your reservoirs at Wood Green as suitable for the purpose of this Bill as the land you propose to take from Alexandra Park?—We have no land adjoining our reservoirs.

In reply to Mr. LANKESTER, who appeared for persons interested in Alexandra Park, witness said he believed clauses could be agreed upon to protect the petitioners against any part of the racecourse being absorbed under the Bill. The racecourse might be left, together with land six yards in width on either side of it. This could be arranged in a special clause which the petitioners could prepare and bring up at a later stage.

Mr. POLLOCK then proceeded to cross-examine witness on behalf of the Enfield Urban District Council, to show that the proposed works would interfere with works of the District Council. He also asked witness, as a sanitary inspector, what his Company proposed to do with the derelict portions of their aqueduct. Did they intend to leave them as bare spaces of mud?

Witness said the point had not been considered. He was sure, however, the Company would not do anything calculated to interfere with the health of the public.

* See "JOURNAL" for June 30, p. 1472.

Cross-examined by Mr. FREEMAN, for the London County Council' witness said that 867 million gallons of storage would be added to the present works of the Company, or about as much as they would get under the Staines Bill. The Staines reservoir water would not be available for some years; and in the meantime provision must be made to meet the wants of the consumers.

Mr. FREEMAN: Do you propose that, to meet your requirements for seven years, you must have power to increase your storage from 169 million to 867 million gallons?

Witness: We need the storage for the purpose of our supply. Up to the present, we have not been in difficulties for water. Last year we helped the East London Company, but, had our wells given out, or our pumping machinery broken down, we should have been obliged to stop the assistance. Continuing, witness said that the storage reservoir at Enfield Chase would be of the utmost service, even after the end of the seven years. He could not say whether, under the powers of this Bill, and of the Staines Bill, the New River Company could legally supply the district of the East London Water Company.

Mr. STUART: Do you suggest that the New River Company, by obtaining these large additional sources of supply, would be able to supply a much larger area—an area extending into that part of the district of the East London Company which that Company find a difficulty in supplying?

Mr. FREEMAN: Yes; and we suggest that they might be subjected to a little parliamentary pressure.

Mr. STUART: Do you mean that we could fix on the New River Company the obligation of supplying a larger area?

MR. FREEMAN: Yes.

Mr. LEES-KNOWLES: And that we could fix the price of the water?

Mr. FREEMAN: Undoubtedly.

Re-examined by Mr. BAGGALLAY, witness said that if the Staines Reservoirs Bill had not been obtained, the New River Company would have required the present measure as it originally stood. They were asking under the two Bills for only sufficient to carry them on until the year 1911. They certainly would not be able to go on for 15 years without the Enfield Chase reservoir. It was proposed originally to take 30 acres of land at Alexandra Park; and under the arrangement just arrived at, the quantity would be only 20 acres.

At this point, the Chairman desired the room to be cleared. The Committee remained for some time in private deliberation; and on the re-admission of the public,

The CHAIRMAN said the Committee were anxious to shorten the work, both for themselves and the learned Counsel. There were certain points on which they had made up their minds, though it was only fair to the promoters to say that, if they desired that further evidence should be given before anything was struck out of the Bill, it would be heard. They could now get so far as to take out of the Bill two or three items—practically to pass the preamble subject to the elimination of those parts, and to the consideration of other clauses—if the promoters did not object.

Mr. PEMBER asked what were the items about which the Committee had that feeling.

The CHAIRMAN said the Committee proposed that the first three items bearing upon the Enfield Chase reservoir should be eliminated, and that other modifications should be made in the Bill.

Mr. PEMBER said the promoters would desire to give further evidence on some of the points referred to.

The CHAIRMAN said that, among other things, they proposed to give the Company ten years of pipe extension. They could not pass the improvement of existing works, and must reduce the item for meters. The clauses covering overspent capital would have to stand. They would prefer to hear more about the Wood Green extension.

Mr. PEMBER said the promoters would like until next day to consider these suggestions.

Tuesday, June 30.

At the opening of the proceedings this morning,

Mr. PEMBER drew attention to the fact that the Committee had intimated that the first three items relating to the Enfield Chase reservoir could safely be dropped out of the Bill, because leaving in the items for the completion of the Whitewebbs well, the mains, and so on, would practically represent an addition of from 3 to 5 million gallons of water per diem. In this way, £305,206 and £30,800 for the reservoir, and £9900 for the Highfield machinery for pumping to the service reservoirs, would be left out; and the £60,000 for the improvement of the channel of the New River conduit could not be passed. The money for the pipe extensions should be reduced; and ten years only would be given for these extensions, as the Company could easily come to Parliament, if they wanted further capital. The Committee could not possibly pass the £10,000 for improvements to existing works and premises, because this was not a matter of public necessity; and the Chairman thought they ought to reduce very much, in proportion to pipe extensions, the additional expenditure for meters. The overspent capital would have to stand. Wood Green they would prefer to hear more evidence upon; for the item would probably be altered by striking out the storage reservoirs—he referred to the subsiding reservoir enlargement, including land, £69,200. The learned Counsel said that, in deference to the foregoing expression of the mind of the Committee, the Company would not trouble them any more as to the storage reservoir at Enfield Chase. The second item of £30,800 they gave up also; but that for the Highfield pumping machinery did not refer to the Enfield Chase reservoir, and could not be abandoned. He would ask the Committee to hear Mr. Francis on the point.

The CHAIRMAN: And there is an item of £79,700, which will be reduced by the absence of the Enfield Chase reservoir.

Mr. PEMBER said that Mr. Francis was of opinion that the item could not be given up. As to the enlargements and additions to the New River—£60,000—this item could be considerably reduced; but they would ask for the mains for the relief of the conduit and the windings about Enfield, and so on. The £60,000 would be reduced to something like £32,000. The County Council had passed the improvements to existing wells, and the enlargement of the filter-beds at Hornsey. The Company would strike out the items for the improvements of works and premises; and as to pipe extensions, they accepted the *dictum* of the Committee that they should have them for only ten years. The item for meters, which came under the head of "miscellaneous capital expenditure"—£12,000—would be subject to reduction; and Mr. Francis would tell the Committee what he would propose. He thought it would be seen from this statement that the Company had done their best to accommodate themselves to what was in the minds of the Committee.

Mr. BALFOUR BROWNE, referring to the Chairman's statement at the opening of the proceedings on Monday, said he understood that was an invitation to his learned friend to do what he had been doing to some extent, and also an intimation to the London County Council to say what they would not object to. The following was the statement he (Mr. Balfour Browne) had written out: "The Committee of the London County Council think that, while any immediately necessary works and extensions might be provided for, powers ought not to be granted this session, the grant of which might, without detriment, be postponed till next session or the session after." All he had done was to insert the words, "next session or the session after" into his reading of the instructions of the House. "They think that, if the Bill be modified so as to apply merely to the improvement of the Company's existing machinery for distributing the water which they may now take, the Company might have such further capital powers as are necessary for the laying of mains for a period of five years at the Company's own estimate of £10,000 a year—namely, £50,000." The learned Counsel remarked that this was considered before the Committee gave any intimation with regard to the £100,000, and, of course, they had given that intimation before hearing the Council's representatives; so he took it that the matter was still open.

The CHAIRMAN: I pointed out that all these things would naturally come up for discussion upon clauses.

Mr. BALFOUR BROWNE: But I am now trying to show what I am prepared to agree to eliminate. "They might also have such powers for capital expenditure on the improvement of filter-beds as the Committee may think necessary." I may say, of course, if there is any other work that the further evidence shows to be absolutely necessary, it ought to be included in the same category with the filter-beds. "Unless the Bill be so modified, the Council must continue their opposition to the preamble, and reserve their full rights to oppose on preamble and clauses in the House of Lords. In the event of the Bill being so confined as not to authorize the taking of any further water"—there is still a clause in the Bill giving power to take water——

The CHAIRMAN: The only power to take water is that which is got by the sinking of Whitewebb's Well, and also improving the existing wells. All power is struck out for new wells.

Mr. BALFOUR BROWNE: Quite so—"and being limited to the improvement of the present works for distributing the water which the Company have no power to take, the Bill might be treated in the same way as the Bills of the Lambeth and Chelsea Companies, provided that the capital powers are limited to those which might be required for the short period already referred to. The additional powers given to the New River Company under the Staines Bill appear to involve an increase of their capital by about 10 per cent.; and if, in addition to this, the capital powers were enlarged to the extent of £50,000"—this is what I was suggesting for the new mains—"and whatever sum the Committee think necessary for the improvement of the filters, that ought to be sufficient, because it would bring up the increase of their capital to something like 20 per cent. of the total of the Company's present capital, which must be more than could be justified under the interpretation which we place upon the present instructions of the House. As regards what is called the legalization of the capital overdraft, this clearly should not be admitted except after full examination of the Company's accounts by a proper authority." If the Company's accounts are laid before you, and vouched for properly, there may be something to be said for this. In the meantime, I am afraid we do not know sufficient to say that we could assent to it. "It is to be observed that either what the Company have done is a mere book-keeping arrangement which they can, of course, correct without special statutory authority, or it is more, and involves giving them a power, the effect of which it is very difficult to foresee. It may give the proprietors a bonus out of capital, for anything we know to the contrary, or it may be money which might have been distributed as profits when collected. But it is not money which the Company are entitled to invest unconditionally in a business returning 12½ per cent. profit." I hope by this statement I have facilitated the Committee.

The CHAIRMAN: I am afraid you have not, after all. I think yesterday we agreed with the promoters of the Bill as to what should be struck out and what should be kept in; and the items that were left over were really the Wood Green reservoir and the enlargement of the conduit, upon which we expressed an opinion, after hearing Mr. Francis's evidence thereon, that it was one of those items that could be postponed. With regard to the other items, we expressed what I might call a preliminary view; and if you think you can convert us from that, of course we are bound to listen to your attempt.

Mr. BALFOUR BROWNE: Of course, I think I could convince anybody that has an open mind; but if, on the other hand, you say that you have made up your minds, then I think I must reserve my opposition for another place. You will remember that you have come to a decision to some extent without hearing our case.

The CHAIRMAN: Without hearing you, certainly. But after all the items that are left over, having taken out the Enfield Chase reservoir, are divided into those that I think every Committee would pass, if they were satisfied with the *bona fides* of the overdrawn capital and the money required for the extension of pipes. On these points, it is only a question now of degree between you and the view enunciated yesterday by the Committee; and we have open minds with regard to Wood Green reservoir.

Mr. BALFOUR BROWNE: I think, undoubtedly, that if any money has been expended upon laying new mains in a new district, it should go to capital account; but if they merely relaid a main, it ought to have been paid out of revenue. But these are questions which, at the

present time, we have not sufficient information to enable us to discuss; and I want to guard against giving away a point until I fully know the significance of it.

The CHAIRMAN: I think it the best course for you to cross-examine Mr. Francis; and after that the Committee will make up their minds as far as they can.

Lord R. CECIL: I think, after the invitation you addressed to us at the end of yesterday's proceeding, it is only right I should explain to you very shortly the position which the County Council of Hertford feel themselves compelled to take. The question of the abstraction of underground water from Herts, is one of the most serious questions which the County Council have to deal with; and the feeling in the county is intensely strong upon the subject. I do not think we should be acting in accordance with the wishes of our clients, if we withdrew from the opposition to the preamble, so long as there remains in the Bill any proposition whatever to increase the supply of chalk water from Herts for the benefit of London.

The CHAIRMAN: I very much doubt whether we can go into that subject; but I will take the opinion of the Committee upon it. The only thing we could say to the Company is, "You shall not take water out of your existing wells," or "You shall not improve your existing wells." Whether or not they can do either of these things, is a question simply of common law.

Lord R. CECIL: The reason we come here, is to prefer what we consider to be a strong equitable grievance.

The CHAIRMAN: The landowners in Hertfordshire could be prevented by the people interested in the river from taking water from their ordinary wells, if your contention is correct.

Mr. *Francis* was then re-called. He gave evidence at some length in support of the statement of Mr. Pember as to the items in the provisional decision of the Committee which the Company considered should not stand. He said, among other things, that, in deference to the opinion of the Committee, he was prepared to give up the Enfield Chase reservoir, which was covered by the item of £305,206, as well as the second item of £30,800, which also had reference to the storage reservoir at Enfield. But the third item they desired to retain, as it related to pumping machinery which was considered necessary. Having gone over the other points detailed by the Committee, witness went on to refer to the proposal to extend the Company's works at Wood Green, which extension they desired to retain, though in a modified form.

Several Counsel representing various petitioners cross-examined witness as to the alleged injury which would be done to the Alexandra Park racecourse. He was prepared to say that the racecourse would not be injuriously interfered with. The Company would arrange their machinery in such a way as to prevent a nuisance arising to their neighbours.

Mr. *R. E. Middleton*, Engineer to the Staines Reservoirs Scheme, was then called. He said that some few years ago he had held an inquiry in Hertfordshire into the question of taking water from the chalk. The investigations he had made covered nearly a year; and he had prepared a report and submitted it to the Royal Commission on the London Water Supply. He had visited the water-cress beds, a large number of wells, and several rivers in Herts and the neighbourhood, and had made experiments and calculations. The result was set out in the appendix to the report of the Royal Commission, and was referred to very fully in the report itself.

Mr. BAGGALLAY: I would ask you this general question: Did you come to the conclusion that a much larger amount of water than is at present pumped might be taken from the chalk basin without doing injury to any material interest?

Witness: Yes; it was found that another 75 million gallons might be abstracted from the chalk per day. At present the amount pumped by the New River Company is 14 million gallons a day; and about 2 million gallons are pumped by the East London Company.

At times I suppose that amount is considerably exceeded?—Yes.

Do you consider that increased pumping would lessen the water flowing in the rivers and streams in Hertfordshire?—So far as I could judge, it would not affect the rivers and streams of the county in any way, except, as I said in my report, quite locally—that is to say, just round the wells themselves.

In reply to further questions, witness said that 164 million gallons of water flowed daily into the chalk basin from which the New River Company pumped their water. The present pumping from the chalk was about 20 million gallons a day, with a maximum of 43 million gallons. He had no doubt that 100 million gallons a day more than was at present abstracted could be taken out of the chalk. The New River Company already took 20 per cent. of the total amount obtainable; and they now proposed to take 5 per cent. more. The Royal Commission reported that 56 million gallons per day could be taken from the chalk; but he thought that an under estimate.

Some conversation here took place as to the necessity of going fully into detail in regard to the abstraction of water from the chalk.

Lord R. CECIL, who had already declared that the subject was one to which his clients attached the greatest importance, said that perhaps it would be well, in order to save time, that this question should be postponed until the Southwark and Vauxhall Bill was before the Committee. He would let the matter rest if his learned friend who represented the promoters would leave the matter undealt with until the clauses of the Southwark and Vauxhall Bill had been arranged.

The CHAIRMAN: To do what is suggested, would be to leave the clauses of this Bill open until the Southwark and Vauxhall measure is before us.

Lord R. CECIL: That is so.

The CHAIRMAN: As we have a fence to jump, we had better ride at it. Short cuts on these Bills do not seem to save time.

Lord R. CECIL, after further evidence on the chalk supply had been given, said he felt it would not be right to go at greater length into this question. The Hertfordshire County Council had obtained the greater part of what they wanted; and they would not therefore proceed with the opposition on this point. Of course, they would still ask the Committee to give a decision as to whether there was really any necessity for these works. In the Southwark and Vauxhall Bill, the question of taking water from the chalk was raised in a very much more important and concrete form; and they would have to go into it much more fully as the gist of the question.

Mr. BAGGALLAY said this also relieved him. He should drop the question of the chalk water.

Sir W. MARRIOTT then addressed the Committee for the Corporation of London. He agreed that, as Alexandra Park had once been dedicated to the public, it should be left open, and that, if the Committee gave the promoters a portion of the park, full and ample compensation should be paid for it.

Lord R. CECIL also addressed the Committee; maintaining that the New River Company had at present ample water for their needs, and that their powers of drawing should not be extended.

Mr. FREEMAN spoke at some length on behalf of the London County Council. He submitted that the Committee should insist on a fair amount being paid by the Company into a sinking fund, and to the whole of the capital being raised by debentures under the auction clauses.

Mr. LITTLER declared that the clauses referred to were unnecessary in this Bill, seeing that the stock was to be issued at such a percentage as the Governor of the Bank of England from time to time considered would ensure par value.

The room was then cleared. On the re-admission of the public,

The CHAIRMAN said: I am sure, Lord Robert, we all feel grateful to you for not persisting in the right to go forward with that very large and deep inquiry into the chalk; but it has enabled us to come to a decision to pass the preamble of this Bill, subject to some alterations in the clauses. Of course, beginning at the list we have had with us since this morning, the first items—viz., £305,206 and £30,800—both come out, as applying, to the storage reservoirs at Enfield. Then the Committee leave in the estimates the £9900 for the Highfield machinery for pumping, £79,000 for the Wood Green filter-beds and machinery, and £8500 for the Hampstead Heath reservoir enlargement. They think that £20,000 should be substituted for Mr. Francis's last figure of £32,816, as quite sufficient for the present wants of the enlargement of the New River conduit. The £27,100 for the completion of the well will stand. The improvement of the existing wells we propose to reduce to the original estimate of £20,000, which, perhaps, will meet Lord Robert's views to a certain limited extent. Then the enlargement of the three filter-beds at Hornsey stands at £6000. The Sunbury improvements, £10,000, are taken out. There are ten years for the pipes, £100,000; and then the superintendence, of course, follows. A sum of £10,000 is for plant and meters, £10,000 for parliamentary expenses, £78,981 is the capital overdrawn, and £7315 will come as part of the Bill. We hope to be able to get at the clauses soon.

Thuraday, July 2.

On the sitting of the Committee this morning,

The CHAIRMAN asked if there were many alterations in the clauses of the Bill.

Mr. REES (Parliamentary Agent to the promoters) said there were numerous excisions, but not much new matter.

Mr. MOON pointed out that there was a considerable amount of opposition on the Alexandra Park and Racecourse question, in respect of which he appeared.

Mr. HENRIQUES said he had an amendment to move on behalf of the Corporation of the City of London to sub-section 2 of clause 3, in view of the instructions given to the Committee by the House of Commons, "to consider whether it is desirable to insert any special provisions with a view to preserving for the use of the public the same quantity of open space as is defined and appropriated for such use by the Muswell Hill Act, 1866; and, if so, to insert such special provisions." Section 25 of the Muswell Hill Act set forth "that part of the estate of the Company which is herein called the Alexandra Palace Grounds shall, after and notwithstanding the expiration or other sooner determination of the said lease, be and continue a place for public resort and recreation, and the public shall have access thereto at all reasonable times, subject to the observance of such rules and regulations as may from time to time be prescribed by the Company." The Corporation of London were the only public body which had the power or means of spending money to protect these open spaces; and in view of that this had provided a clause to this effect: "Provided always that the Company shall, before they enter into possession or occupation of the lands described in clause 5, sub-section I., set aside an equal area of adjacent land the property of the Company, which land shall be and continue a place for public resort and recreation; and the public shall have access thereto at all reasonable times, subject to the observance of such rules and conditions for the benefit of the public as are the lands referred to in section 25 of the Muswell Hill Estate and Railways Act, 1866." The City felt very strongly that, as they were the only public body which could look after this matter, some provision should be made for maintaining all the open spaces possible in and around London; and they desired to strongly press upon the Committee the adoption of this clause.

Mr. FORBES LANKESTER, representing Messrs. Pratt, the lessees of the Alexandra Park Racecourse, said this would be a convenient time to bring up the clauses prepared on behalf of his clients, to carry out the arrangement to which Mr. Francis, the Engineer to the promoters, had assented when giving evidence on the Bill. He (Mr. Forbes Lankester) understood that the promoters were willing to accept the clauses which he had prepared, with the exception of one dealing with the question of taking stables standing on the property, and reinstating them elsewhere. The racecourse in question had been let for 14 years to his client. They had constructed stands, and made all the necessary arrangements for racing, and had established races four times a year. It was most important to the tenants that their right to hold these meetings should be preserved. As would be remembered, Mr. Francis in cross-examination had said that he could so arrange the taking of the water and his reservoirs as not to interfere with the racecourse. The first clause was to the effect that the water-works should not come within 6 feet of the racecourse on either side, and that a fence should be put up so as to keep the view of the reservoirs from the horses while they were running. The third clause was: "The Company, before taking possession of the stables at present standing on the

land to the south and east of the racecourse authorized to be taken by them, shall erect new stables with all proper fittings and water supply, affording at least as much accommodation as the present stables. Such new stables shall be erected on such part of the land comprised in the lease to the lessees from the London and Middlesex Freehold Estates Company, Limited, as may be prescribed by that Company and the lessees, and shall be constructed of good sound materials, and with good workmanship, to the satisfaction of that Company and the lessees." Another clause he proposed (and which he understood the Company were prepared to accept) was to the effect that the Company should not allow steam to be emitted by their engines on racing days between one and five o'clock p.m.

Mr. BAGGALLAY: We have here really two totally distinct points. The last point of the clause of my learned friend Mr. Forbes Lankester would be very much better to be kept distinct from the more important point—that is the question that arises under the instructions about the provision of land in lieu of the 6 acres that we propose to take at Wood Green. The instructions are that it is for "the Committee to consider whether it is desirable to insert any special provisions with a view to preserving for the use of the public the same quantity of open space as is defined and appropriated for use by the Muswell Hill Act, 1866; and, if so, to insert such special provisions in the Bill." In the first place, on this question of providing 6 acres as proposed by Mr. Henriques for the City, it is necessary that I should prove some facts to you, and I must do it by question and answer, because it will have to form the foundation of the report you have to make upon the subject to the House. I shall have to prove how this land is now occupied.

The CHAIRMAN: I think we are all agreed that the common law really provides for Muswell Hill. We cannot add land at Muswell Hill; but you would have to give them the money for the land you take, and they can invest it in other land.

Mr. BAGGALLAY: That will be a matter for the owners, of course. They must exercise a discretion with reference to the expenditure of money, if they are under any statutory obligation that will bind them. If they are not, it will not. Then, Sir, I will only ask, for the purpose of the report, one question of Mr. Francis.

Mr. *Francis* was then re-called, and further examined by Mr. BAGGALLAY. He said that the 6 acres they proposed to take were to a certain extent now covered with buildings, stables, pumping-stations, and so on. They were not at the present moment available for the public for the purposes of recreation, and had not been so for some considerable time.

The Committee, after further discussion, agreed to the proposed amendments. The words "or other, the lessees for the time being," were omitted from the first sub-section of the last-mentioned clause; and the words "being or claiming to be the lessees," were substituted.

Mr. BAGGALLAY said the promoters objected *in toto* to sub-clause 3, requiring them to reinstate the petitioners in their stables. They objected to doing this for a lessee whose tenure in any case ended in 14 years, and might be determined at any time if he lost his licence from the Jockey Club. Under these circumstances, the Company objected to go to capital expenditure to provide stables.

The CHAIRMAN said the Committee could not accept the proposal of the petitioners. The Company would give them the money; and they would build their own stables.

Mr. FORBES LANKESTER said that the lessors would get the money. The clauses would be valueless without the amendment; and the Committee would, by a side wind, be depriving the petitioners of the use of the racecourse.

The CHAIRMAN said the petitioners would have a claim for compensation against the lessors under the Lands Clauses Act.

The part of the clause relating to the emission of steam from the Company's engines was altered so as to read "not exceeding six days in any one year and of which 14 days' notice has been given by the lessees to the Company so to use any engine that may be put upon the land lying on the south and east of the racecourse which may be taken by them that no steam visible from the racecourse shall be emitted therefrom between the hours of one and five p.m."

Clauses were inserted on behalf of two property owners—Dr. Raynor and Mrs. Sharp—whose land was to be taken for the purpose of the enlargement of the reservoir at Hampstead. The object of the clauses was to preserve the amenities of the dwelling-houses of the petitioners, and to require that the Company's works should not be unsightly.

Some further clauses were considered, and the Committee adjourned until the following Monday.

Monday, July 6.

On the resumption of the proceedings this morning, clauses were again considered.

Lord R. CECIL, for the Middlesex County Council, brought up a clause to require that all bridges in the county of Middlesex carrying the highway across the New River, and which should be rebuilt, altered, or extended, should, with the approaches thereto, be not less than 14 feet wide between the parapets, should be strong enough to bear a 15-ton roller, and of a less gradient than at present. The noble lord pointed out that these bridges belonged to the New River Company, and therefore were obstructions on the county roads, and the County Council maintained that it was the duty of the Company to repair them.

Mr. POPE opposed the clause, on the ground the Committee had already decided the question as to who was to pay for the bridges in the Staines Reservoirs Bill. If bridges were pulled down, of necessity the Company no doubt ought to restore them; but if the local authority required them to be pulled down or altered, the work should be performed at the cost of the authority.

Clauses were then proposed providing that the New River Company should not take water by means of wells from the land acquired under the Bill, and giving the Water Examiner a recognized status.

The room was cleared, while the Committee remained for some time in private deliberation. On the re-admission of the public,

The CHAIRMAN said they had come to the conclusion that in rebuilding the bridges an obligation ought to rest on the New River Company to make them 25 feet wide. The Company must give notice to the local authority when about to rebuild a bridge; and if the local authority desired to have a greater width than that named, they must contribute towards the cost. As to lessening the gradient, that must fall entirely on the local authority. When bad, some of the gradients might be a little improved; but on the whole they were not bad for road traffic. The Committee would not require the Company to abstain from taking water from the land they were now acquiring, as the quantity of land taken was but small. As to the Water Examiner, the Committee would present a special report to Parliament, calling attention to the fact that no action had been taken on the report of the Royal Commission, which was to the effect that a recognized status should be given to the Water Examiner.

Mr. POPE said that he gathered that the Committee did not propose to put a clause in the Bill in reference to the Water Examiner, but that they would make a special report to Parliament calling attention to the matter as applying not only to the New River Company, but to all the London Water Companies.

The remaining clauses of the Bill were afterwards disposed of; and the Bill, with amendments, was ordered to be reported to the House for the third reading.

Special Report by the Committee.

On their appointment, the Committee received special instructions from the House, dated March 24, as follows: "That it be an instruction to the Committee (*a*) not to confer additional powers, except so far as the same may be proved to the satisfaction of the Committee to be required for works or for the acquisition of land, the construction or acquisition of which cannot be postponed without detriment to the interests of the public; and (*b*) to insert in any Bill authorizing the creation of further capital, provisions which shall prohibit the application of such capital to any purpose other than the construction of the works or the acquisition of the land for which it is authorized by the Bill to be raised, or the expenses of the Bill." At the close of their inquiry, the Committee made the following special report:—

Your Committee beg to report that they have had before them the following Bills: The Chelsea Water Company's Bill, the Lambeth Water Company's Bill, the Staines Reservoirs Bill, the New River Water Company's Bill, and the Southwark and Vauxhall Water Bill. They have passed the preambles of the first four of these Bills, making extensive alterations in clauses; and in the case of the Staines Reservoirs Bill, considerably amending the preamble. They found that the preamble of the Southwark and Vauxhall Bill was not proved.

In dealing with these four Bills, your Committee have observed, to the best of their judgment, the instruction given to them by the House, and have confined the powers conferred upon the several Companies to those works and that acquisition of land "which could not, in their judgment, be postponed without detriment to the interests of the public."

The evidence before your Committee clearly points out that no large new source of water supply for the constantly increasing wants of the districts concerned could be made available for at least thirteen to fourteen years from the present time, and that therefore the population must be supplied from sources now available for at least that period; and that as the present powers of supply of some of these Companies will during that period become exhausted, and the storage is already inadequate, provision must be made, in the public interest, for the further supply and storage of water required in the interval. The population deriving their daily water supply from the Companies whose Bills have been under consideration amounts to no less than 3,863,566.

While it has been alleged that the prevention of waste would in some cases place more water at the disposal of the Water Companies, on the other hand, the rapid growth of the population, the substitution of constant for intermittent supply (under the present limited powers of inspection), and especially the largely increasing consumption per head for domestic, sanitary, and municipal purposes, outweigh the savings and economies that any practicable methods could introduce.

In addition, the imperative demand for water compels that some provision should be made for exceptional drought, floods, frosts, and those casualties to which a water supply is always liable, and also to prevent an undue depletion of the flow of the Thames. The storage, in the cases of two of the three Companies interested in the Staines Reservoirs Bill—namely, the New River Company and the Grand Junction Water Company—is greatly deficient, and far short of the estimate of the Royal Commission of 1893, and of the amount deemed by the Water Examiner and other experts to be necessary to secure a good, wholesome, and constant supply.

It has been suggested that more water might be obtained by pumping direct from the River Thames, in order to meet any immediate emergency, and thus avoid a present outlay in storage reservoirs. But it seems to your Committee that this expedient would only aggravate the acknowledged evils and dangers of deficient storage, and might involve taking water direct from the river, instead of from a storage supply drawn from the river at times most suitable for pumping.

Your Committee have had before them reports from the Local Government Board and from the Board of Agriculture on these Bills; and they have endeavoured to embody in the Bills the suggestions made by these authorities.

The price of issue of the stock to be raised will in all cases be settled by the Governor of the Bank of England. It will be sold subject to the standard auction clauses. Any premiums received will be reckoned as part of the authorized capital. Powers to redeem the stock at par at the end of 25 years have been inserted. The sinking fund clauses have been adapted to all the money raised in each case.

In the Staines Reservoirs Bill, a clause has been inserted to the effect that, in the event of a sale of any of the undertakings of the three subscribing Companies, within seven years from the passing of the Act, to any public body or trust, the advantages conferred by the Act shall not be deemed to have enhanced the value for purposes of sale of the undertakings of any of the three Companies obtaining the Act. A clause has also been inserted bringing the Staines Reservoirs Committee under the Auditor appointed by the Metropolis Water Act, 1871.

During the course of their inquiry, your Committee have frequently had their attention drawn to paragraphs Nos. 176, 177, and 180 of the

report of the Royal Commission on the Water Supply of the Metropolis, dated Sept. 8, 1893. No regulations yet exist, as recommended by the Royal Commission, as to the processes deemed necessary before water is in a fit condition to be supplied to the consumer. No statutory regulations applying to all Metropolitan Water Companies are in force as to the periods for pumping, nor as to the proper appliances and regulations for the subsidence and filtration of water. The Water Examiner, "while treated with the greatest courtesy by the Water Companies," has no legal right of entry, or power to check the quantities taken out of the rivers, wells, and springs, as reported to him by the Companies, or the quantities delivered into the mains for the supply of consumers.

While it is practically proved, by the low rate of mortality from typhoid fever in the Metropolis [Professor Frankland's report, in the 24th Annual Report of the Local Government Board, p. 145. 1894-5], that care is taken to ensure a good and wholesome supply of water, your Committee submit that, where the health of so enormous a population, confined in so comparatively small an area, is concerned, these most important questions ought at once to be dealt with by the Executive Government. As your Committee have elsewhere pointed out, London must be supplied under any circumstances for several years to come, and probably always to a great extent, from the present sources of supply; and therefore, in any event, such regulations as are recommended in the above-named paragraphs of the report of the Royal Commission are imperatively necessary, and ought, in the judgment of your Committee, to be framed and put in force without delay.

Your Committee would, with great deference, point out that the present position of the London Water Supply is not in accordance with the public interest. Under the conditions of issuing new capital, now invariably approved by Parliament for the London Water Companies, the public is steadily acquiring an interest which tends to weaken the enterprise of the Companies as private concerns; while, on the other hand, the consumer is left without that care of his interests which is ensured by placing the supply under a representative body in whose election he is personally interested. In the meantime, each session applications to Parliament—sometimes inconsistent, and usually without concert with one another—are being made which are opposed by local authorities and private persons. These proceedings are annually costing a very large sum of money, and Committees of Parliament, being obliged to consider each proposal separately, without reference to any general scheme, have the almost impossible task assigned to them of deciding what powers should be granted to the Water Companies in order that they may provide for the wants of an ever-increasing population, and what powers withheld to avoid the Water Companies acquiring an increased value, in the event of purchase by a public authority. From this acknowledged anomalous position, it would be greatly to the public interest that both the Water Companies and the inhabitants of London should be speedily freed.

Barry Corporation Bill.

The Bill promoted by the Barry District Council to enable them to acquire Cadoxton Common, to construct new water-works, to extend the limits of the supply of gas and water, and for other purposes, has lately been under the consideration of the Police and Sanitary Regulations Committee of the House of Commons. During the proceedings last Thursday, Mr. Freeman, who appeared for the Cadoxton Commoners, the only remaining petitioners against the Bill, announced that a settlement had been effected. The preamble was therefore declared proved, and the Bill allowed to proceed.

Gas v. Electric Lighting at Cape Town.—Cape Town papers note that the municipal supply of the electric light in Cape Town has done the Gas Company no harm. The number of gas-stoves in use in the town has gone up by leaps and bounds while the supply of the suburbs of Green Point has increased so much that the mains have had to be taken up and replaced by others of much larger diameter.

The New Water Supply at Bilston.—The water-works which the Bilston District Council have erected at the Bratch, Wombourn, have now been completed; and satisfactory tests of the mains, machinery, and plant having been made, the water was turned on by Mr. J. W. Sankey, Chairman of the Council, on the 2nd inst. The water is forced from the water-works up to a reservoir at Goldthorn Hill, which stands higher than any part of Bilston, and from there it will gravitate to the town. Hitherto Bilston has been supplied with water by the Wolverhampton Corporation; but the latter, for a sum amounting to about £9000, gave up their rights, and sold to the Bilston authority the whole of their mains.

The Financial Working of the Bury Corporation Gas-Works.—At the monthly meeting of the Bury Town Council last Thursday week, the Chairman of the Gas Committee (Mr. Byrom) dealt at some length with the results obtained in the working of the department during the last financial year. He said that, though the profit made was not equal to that of the previous year, he was sure the members of the Council would be satisfied with the result, as it was clearly shown by the accounts that, had the residuals realized the prices obtained in the preceding twelve months, the profits would have considerably exceeded those of 1895. The total income from gas and rents amounted to £34,585, as against £33,385 in 1894-5, or an increase of £1200; showing an increase in the consumption of gas equal to 3·34 per cent. For residual products a sum of £10,407 was obtained, as against £11,963 for 1895, or a drop to the extent of £1556. There was an increase on the sale of coke and tar products of £213; and if the Committee had received the same price for sulphate of ammonia as in the previous year, the net profits instead of being £1969, would have reached £3738. They produced 9½ million cubic feet more gas, and this with a saving of £800 in the coal account as compared with 1895. Economy in various other directions saved the Corporation something like £500. During the year, they provided £5688 as a contribution to the sinking fund and redemption of stock; and they paid £2936 in rates levied against them.

LEGAL INTELLIGENCE.

HIGH COURT OF JUSTICE—CHANCERY DIVISION.

Friday, July 10.

(*Before Mr. Justice* STIRLING.)

The New River Company v. Miller—Illegal Use of a Stamp for Water-Fittings.

Mr. HASTINGS, Q.C., moved on behalf of the plaintiffs in this action for an injunction restraining the defendant from fixing the plaintiffs' test mark or stamp of approval to water-waste preventer cisterns and other apparatus which had not in fact been tested or passed by them, and also restraining him from selling any apparatus so stamped which had not been approved by them. Since 1885, the plaintiffs had established an office for the purpose of testing and stamping water-fittings. The result of inquiries which had been set on foot was that it was discovered that the defendant had been transferring the Company's stamp from old and worn-out cisterns to new ones.

The defendant appeared by Counsel, and submitted to a perpetual injunction in the terms stated, with costs—no damages being applied for by the plaintiffs. It was further asked that defendant should be ordered to deliver upon oath an account of all cases in which he had affixed the plaintiffs' mark to water-fittings which had not been tested or marked by them; and that he should remove or cancel the test mark or stamp on all fittings in his possession or under his control. This was also submitted to by the defendant.

His LORDSHIP made the order accordingly.

BRISTOL SUMMER ASSIZES.—Saturday, July 4.

(*Before Mr. Justice* DAY.)

Claim against the Bristol Gas Company—Liability for Damage to a Sewer by a Gas Explosion.

This was an action by the Corporation of Bristol against the Gas Company to recover damages to the extent of £98 in respect of injury caused to a sewer by an explosion of gas in the Sefton Park Road. It was alleged that, through the improper laying of a gas-pipe, gas escaped into the sewer.

Mr. A. R. POOLE, Q.C., and Mr. F. E. WEATHERLY appeared for the Corporation; Mr. T. T. BUCKNILL, Q.C., M.P., and Mr. DOUGLAS METCALFE, for the Company.

Mr. POOLE, in opening the case, stated that the sewer in question was made in July, 1893, and passed by the Corporation officials. In February, 1894, the Company laid their main, and took a connecting-pipe across the road, over the newly-made sewer trench, to supply a lamp. In September, 1895, a strong smell of gas was observable for a fortnight. At last the people complained so much that Mr. Alfred Hill, the builder who made the road and laid the sewer, wrote to the Company; and they then sent men to repair the pipe. The men applied lighted tow, and found that the earth was so much charged with gas that it immediately took fire, and caused a flame 2 feet high over an area 4 feet square. With difficulty the fire was extinguished. In the afternoon, the ground was opened; and it was found that the service-pipe had been torn away from the main. This was repaired and tested with lighted tow, and found to be all right. But in waving the tow about over the ground to extinguish the flame, one of the men caused an explosion, which blew up the sewer manholes and otherwise damaged the sewer, which, after it was laid, belonged by law to the Corporation. It was then apparent that the gas had escaped into the sewer. The only question for trial was that of liability; it being agreed that £98 damage had been done to the sewer.

Mr. *C. F. Ball*, the Assistant Borough Engineer, described the sewer, which he said was properly laid, but not ventilated. It was not the custom in Bristol to ventilate the main sewers.

Cross-examined: It was not particularly necessary to ventilate this sewer, though gases might get into it from the main sewer of the district. All the main sewers of Bristol were non-ventilating; each house being trapped off, and having a ventilator.

Mr. BUCKNILL: The Public Health Act, 1875, section 19, says: "Every local authority shall cause the sewers belonging to them to be constructed, covered, ventilated, and kept so as not to be a nuisance or injurious to health." And yet the Bristol Corporation do not ventilate their sewers?

Witness: It says kept so as not to be injurious to health. It is not injurious. The sewer is perfectly clear now.

Cross-examination continued: Before the houses were built, the junctions in the sewer were stopped by placing a stone in front, to keep out the earth. Asked whether if only 150 houses were connected and 50 junctions remained unconnected, the liquid and sewer gas would escape through them, witness replied that the liquid would not, because the junction was too high up, but sewer gas might. At the time of the explosion, all the houses along where the explosion occurred were connected.

Mr. BUCKNILL: Would you be surprised to find that, on opening the manholes, they were found to be full of sewer gas?

Witness answered that they always expected some smell for a time. While he was of opinion that the sewer was properly laid, he had to admit that coal gas got into it in some way.

Re-examined by Mr. POOLE: Bristol sewers were not ventilated in the streets. Where such ventilation existed, there were constant puffs of gas, which made people complain continually. In addition to the traps at houses, there was a ventilator up the wall outside the houses; and, rightly or wrongly, in Bristol that was believed to be the best system of ventilation.

Other witnesses were called on behalf of the Corporation, to prove that the sewer was well laid.

Mr. *Alfred Hill*, builder and contractor, who constructed Sefton Park Road and the sewer, deposed that the sewer was properly laid.

He had smelt the escape of gas ten days before he wrote to the Gas Company. He was present at the time of the explosions, which he described as being like "three claps of thunder." The manholes were wrecked; and material was blown up 40 or 50 feet high. He attributed the fracture to the fact that the Gas Company did not properly ram their trench. Then, when the heavy freestone was carted along the road, a deep rut was made; and the lead service was wrenched from the main. The same thing had also happened to the water-pipes in the road. The mysterious thing about this particular gas service-pipe being disconnected was that the lamp remained alight. He supposed this was owing to the pressure of the gas.

Evidence was given as to the action the Company's workmen took in looking for the escape of gas; and other witnesses were of opinion that the use of a light by them was negligent.

Mr. BUCKNILL, addressing the jury for the defence, said anything more flimsy and uncertain than this alleged cause of action he had never heard in a Bristol Court. At most, it was a pure accident. The connection with the gas-main had been made fourteen months before the escape. There was no evidence of negligence in laying the gas-pipes or in making the sewer. The driving of the heading for a drain immediately under the gas-main was the cause of the sinking of the earth; and when a heavy load of freestone passed over, the pipe was injured. It was clear there was no escape of coal gas at the time the heading was made.

Workmen in the employ of the defendants deposed that the main was properly laid; that the service-pipe was originally put on a firm bed; and that the trench was properly rammed.

Henry Bobbett described the use of the lighted tow, and said he was knocking out the flame when the explosion occurred. The ground under the pipe was loose.

Henry Jenkins, a gas-fitting foreman to a private firm, with 30 years' experience, said he should never leave a joint without testing it by applying a light.

Mr. *Fiddes*, Engineer to the Gas Company, described the condition of the trench and sides, which was very loose. A torch was the only test used by the Company for the past 30 years; and no other was reliable in damp ground.

Professor *Stuart*, Mining Engineer, said coal gas must have passed into the sewer to cause the explosion.

His LORDSHIP, in summing up, said he could see no evidence of contributory negligence; and the question of the ventilation of sewers was utterly irrelevant. Moreover, he did not see that the Corporation were bound to seal up their sewers to keep out the coal gas. The question for the jury was whether the defendants were responsible for the escape of gas from their pipe, and for allowing it to remain so long without stopping it.

The jury found for the plaintiffs; and judgment was accordingly given for £98.

SURREY QUARTER SESSIONS.—Friday, July 3.

(*Before Mr.* G. CAVE, *and other Magistrates.*)

The Rating of the Lambeth and Chelsea Water Companies' Property.

To-day, the Court was occupied in hearing rating appeals; among them being two by the Lambeth and Chelsea Water Companies.

Mr. HORACE AVORY, Q.C., appeared for the appellants; and Mr. CHANNELL, Q.C., for the respondents.

Mr. AVORY first directed attention to the Lambeth case; remarking that he was glad to inform the Court that, as far as the proceedings that day and in that Court were concerned, the Magistrates would not be troubled with any questions of fact. He was going to submit that there were authorities clearly in favour of what his clients contended; and he had learnt from his learned friend that it was the wish of the respondents that these authorities should be tested in a higher Court. The point arose in this way: The East and West Molesey District Council came into existence as an urban authority in 1895; and in making the general district rate, they had assessed the Lambeth Water Company upon the full value of their property as it appeared in the valuation list. The appellants contended that, under section 211 of the Public Health Act, 1875, they were entitled to have their reservoirs assessed at one-fourth only of the net annual value. The rate which they appealed against was one made by the Council on May 16 last, under which the Company were assessed at £5200. He understood that the Assessment Court had assessed the reservoirs separately at £3100. Should the Court be willing to act upon the respondent's suggestion, and state a case for the higher Courts, he would ask them to exercise their power and make an order separating the reservoirs from the rest of the property, and allowing them to be put in the rate at one-fourth of the net annual value.

Mr. CHANNELL argued that it was one rateable hereditament, and that a part could not be picked out and separately rated. The reservoirs were artificial structures for the purpose of storing water; and his contention was that they did not come within the meaning of "land covered with water," which he contended meant land naturally covered with water, or something of that kind. Of course, the meaning was to rate at a lower figure something that was unprofitable; but in this instance it was not the case. Therefore he did not think it came within the meaning of his friend's contention.

After a short consultation,

The CHAIRMAN said the Court decided in favour of the appellants, with costs. The question in their minds was whether they ought to state a case or not for the decision of the higher Court; but they thought it would be only fair to do so.

In the Chelsea Water Company's case, only formal evidence was tendered by the Engineer (Mr. R. Hack). The Court gave a similar decision; and also consented to state a case.

Infringements of the Incandescent Gas Company's Patents.

In the Chancery Division of the High Court of Justice, before Mr. Justice Chitty, last Saturday, a motion for judgment (in default of appearance) was made in the case of the Incandescent Gas-Light Company *v.* Hamer. Mr. Walter, who appeared for the plaintiffs, said it was an action for infringement of the three patents of 1885, 1886, and 1893; and the particulars of breaches were of the ordinary character in these cases. The usual order for an injunction, delivery of the infringing articles, and an inquiry as to damages and costs was made. The same order was made against the New Evening Sunlight Incandescent Company, under similar circumstances. Another action of the same kind against a defendant named Price appeared in the list; but Mr. Walter said it had been settled. Two other actions, which had been placed in Mr. Justice Chitty's list by mistake, were struck out. Mr. Justice Kekewich, on the same day, made a similar order to the above against a defendant named Collins.

Serious Assault on a Gas Company's Official.

At the Northern Police Court, Dublin, yesterday week, John Nulty was charged with a serious assault on Mr. W. F. Cotton, Assistant Engineer of the Alliance and Dublin Consumers' Gas Company. Mr. Cotton was examined, and stated that the prisoner had been in the employment of the Company, but was discharged for drunkenness last February. On Saturday last, he was watching Mr. Cotton from half-past two till four o'clock. Mr. Cotton left the Company's premises at that hour, and the prisoner followed him. He came up to him saying, "Any chance of a job, Mr. Cotton?" He replied, "Not at present." The prisoner then used abusive language, and struck him in the face with his clenched fist, knocking him down. He then kicked him in the back, and smashed his umbrella. He reported the matter to the police, and had the prisoner arrested. Corroborative evidence was given. The prisoner pleaded that he was drunk, and remembered nothing of the occurrence; but Mr. Cotton declared that the man was perfectly sober. Prisoner was then returned for trial to the County Commission.

Kirkby Lonsdale District Council and the Gas-Works.—The Kirkby Lonsdale Gas Company have, in reply to an inquiry by the District Council, informed that body that they are willing to treat for the sale of their undertaking on the basis of arbitration. The proposal seems to have met with the general approval of the members of the Council.

Dawlish Water Supply.—An inquiry was held at Dawlish on Wednesday by Colonel C. H. Luard, one of the Inspectors of the Local Government Board, respecting an application by the District Council for power to borrow £925 for works of water supply. The extensions contemplated include a main 760 yards in length from the reservoir to Houndspool, and a tank for storing water for street watering.

The Gas-Supplying Companies of Hull.—Colonel Goddard writes to the "Hull News," recommending the Corporation to attempt to effect an arrangement with the Kingston Gaslight Company and the British Gaslight Company, for the latter to supply gas within the Old Town as well as without, and do away with the works of the former. By this means, he argues that the present unsanitary gas-works of the Kingston Company near the Town Hall would be removed, and nearly an acre of most valuable land would be available for the extension of the Town Hall, while a large pecuniary benefit would accrue to the present gas consumers within the docks, who are now paying 3s. per 1000 cubic feet of gas, as against 1s. 10d. charged by the British Gas Company. The scheme (says our contemporary) certainly has the merit of boldness, and would yield the advantages named; but is anyone daring enough to propose it in the Council?

Tiverton Corporation Gas-Works.—A statement respecting the first year's working of the Tiverton Gas-Works since the transfer to the Corporation has just been issued. The works formerly belonged to Messrs. Heathcoat and Co., a local firm of manufacturers, and a Provisional Order authorizing their transfer to the Corporation is now before Parliament. In the meantime, the Corporation are carrying on the works under an agreement with Messrs. Heathcoat and Co., by which they are to pay 4 per cent. interest on £20,000—the amount of the purchase money—until the Provisional Order is obtained, and the transfer is completed. The accounts show that the total make of gas was 26,647,000 cubic feet, and that there was sold by meter 21,665,100 feet, and used for public lighting 3,819,800 feet—the unaccounted-for gas being 2,970,100 feet. On revenue account, the income was £4412; and the expenditure, £4041. There was thus a balance of income over expenditure of £371; but the receipts were actually only for three quarters, while the expediture was for the whole year. The estimated profit for the entire year is put at £1826, or £450 in excess of the figures on which the purchase was calculated.

The Cost of Labour at the Dukinfield Gas-Works.—The Gas Engineer of the Dukinfield District Council (Mr. Harrison Veevers) has lately presented to the Gas Committee a report on the cost of labour in connection with the manufacture and distribution of gas in the years ending March 25, 1886 and 1896; showing the cost of each item and the cost per 1000 cubic feet of gas made and sold, exclusive of the salaries of the Manager and Cashier. In 1886, the quantity of gas made was 61,767,000 cubic feet, of which 48,902,200 cubic feet were sold—a difference of 12,864,800 cubic feet, or at the rate of 20·82 per cent. The prices then were 2s. 11d. to 3s. 4d. per 1000 cubic feet. In 1896, the make of gas was 67,224,000 cubic feet; the sale, 60,997,000 cubic feet—a difference of 6,227,000 cubic feet, or at the rate of 9·26 per cent. The prices are now 2s. 6d. to 2s. 11d. We reproduce the principal of the labour items for the two years: In 1886, stoking cost £896; coal wheeling, &c., £14; purifying, £65; repairs, £131; general expenses, £85; salaries (distribution), £249—the total being £1706, or 6·630d. per 1000 cubic feet of gas made, and 8·374d. per 1000 cubic feet sold. In 1896, stoking cost £1011; coal wheeling, &c., £46; purifying, £35; repairs, £214; general expenses, £168; salaries (distribution), £361; and sulphate making (an extra item), £29—the total being £2143, or 7·752d. per 1000 cubic feet of gas made, and 8·543d. per 1000 cubic feet sold.

MISCELLANEOUS NEWS.

THE INSPECTION OF GAS LIQUOR AND OTHER WORKS UNDER THE ALKALI ACTS.

The Sub-Inspectors' Reports.

In the "JOURNAL" for the 23rd ult., we noticed the report of the Chief Inspector under the Alkali, &c., Works Regulation Acts (Dr. R. Forbes Carpenter) for the past year. Reference was then briefly made to the report of the Sub-Inspectors, some extracts from which we now give.

The first district dealt with is Ireland; and it is under the supervision of Mr. E. G. Ballard. He states that the sulphate of ammonia works were carefully conducted last year, and that the works generally are in good order. Efforts are being made this coming year to induce a further adoption of the oxide purifier for the absorption of the sulphuretted hydrogen evolved in those works where at present this noxious gas is burnt or passed into the retort-flue. The complete destruction of the sulphuretted hydrogen when introduced into the gas-retort flues is not, he says, to be depended upon, especially when the number of retorts in operation is small. Taking all the places where sulphate of ammonia is manufactured in Ireland, the number of works absorbing the sulphuretted hydrogen in oxide purifiers is 20; those burning, 7; those working on continuous system of distillation, 14; and those working on the intermittent system, 13. The continuous process of distillation continues to make progress in the district. There were 2741 tons of sulphate of ammonia made during the year. With regard to works for the distillation of tar, with one exception they were properly conducted.

Reporting upon the North of England district, Mr. Bernard E. Smith says there is little to note in the way of change in sulphate of ammonia apparatus in the district. Some new small plants were constructed and commenced operations during the past year; but as the gas liquor which they use had been formerly treated at other plants in the district, they hardly account for the slight increase in output. The quantity manufactured was 6609 tons, of which 846 tons was made from liquor obtained in the manufacture of coke. As mentioned last week, Mr. Smith notices the accident at the Tynemouth Gas-Works, which occurred while his report was being prepared. In his next he will have something more to say thereon, and some useful suggestions t o bring forward.

In the district comprising Cheshire, North Wales, and part of Lancashire, of which Mr. Ballard has the supervision, all the works producing sulphate of ammonia were carefully conducted. Of the total number, 21 work on the continuous system, 8 on the intermittent system, 20 absorb the sulphuretted hydrogen in oxide of iron, 9 burn it, and in one it is converted into sulphur in a Claus kiln. The total production was 3671 tons. With regard to tar-works, Mr. Ballard notices a novel arrangement of purifier in use in one establishment. It consists of a heap of oxide on trays or grids, placed over a pit sunk in a cement floor. This form of purifier possesses the advantage of allowing the oxide to be easily turned for revivification; the whole being covered by a light shed.

In East Lancashire and part of Yorkshire, which is now under the charge of Mr. G. Morley Fletcher, the total quantity of gas liquor worked up into sulphate, muriate, and liquor ammonia last year was 26,010 tons, as compared with 24,484 tons in 1894. At two works attempts have been made to revivify the oxide *in situ* by passing in air along with the foul gases from the saturator; but with only partial success. At one works, it was difficult to supply the necessary steam close to the purifiers; hence the result has not been satisfactory—the oxide becoming hard and dry, and eventually so hot as to set fire to the grids. In several instances, the chimney draught is utilized for sending air downwards through the oxide, for the purpose of revivification when the plant is stopped; and this is also very useful for drawing away any foul gas from the men when they are engaged in emptying a purifier. The number of tar-works has increased by one; but there is little change to be recorded.

A large portion of Mr. Jackson's report on the South Midland district is devoted to gas liquor and tar works. The manufacture of sulphate of ammonia is carried on in 71 works; in one of which muriate of ammonia is also produced, and gas liquor concentrated. In two others making sulphate, the liquor is concentrated for use in ammonia-soda works; at a fourth works, where sulphate is produced, this process is also carried on. In one of the works muriate only is manufactured. This makes a total of 73 works where ammoniacal products are made. Three additional works have been registered. The methods of dealing with the sulphuretted hydrogen in these are as follows: (1) Oxide of iron purifier, revivified *in situ;* (2) oxide of iron purifier; (3) passed into the hydraulic main. There has again been trouble with the brick purifiers in several places. A very small crack or defect in brickwork is sufficient to allow sulphuretted hydrogen to escape, thereby causing nuisance. Where the Claus process of dealing with the noxious gases is adopted, the hot end of the sulphur chambers is the weak point. Owing to the expansion of the brickwork, they require to be periodically rebuilt. Mr. Jackson says the brickwork should be supported by iron stays bolted across the top of the chamber. In three out of the five works using this method, the kiln end of the chambers had to be rebuilt during the past year; and at a fourth will have to be done shortly. There is very little change in the proportions of the different methods in use for arresting the noxious gases. At one works where oxide purifiers were employed the sulphuretted hydrogen is now sent into the pyrites burners. This plan of directly utilizing the sulphuretted hydrogen for the production of sulphuric acid is now adopted in ten works; and it is one which Mr. Jackson would like to see employed in all works where gas liquor is distilled with sulphuric acid plant attached. An average gas liquor is said to yield about 3 cwt. of oil of vitriol for every ton of sulphate of ammonia produced, or 20 per cent. of the oil of vitriol required for the manufacture of the sulphate. It has, further, the advantage of extreme simplicity; and no complaints are made of excessive nitrate consumption now that the best method of burning the sulphuretted hydrogen in the kilns is understood.

In addition to the sulphuretted hydrogen passing away from the condensers attached to the sulphate of ammonia plants, there is another source from which nuisance may arise, if not carefully watched—viz., the disposal of the so-called "devil water" from the condensers. Mr. Jackson says the offensive smell arising from this is due, not only to sulphuretted hydrogen, but probably to pyridine. At one works, plant was erected during the year for filtering the water through oxide of iron. The sulphuretted hydrogen is easily removed in this way, and the offensive water thus considerably purified; but the characteristic smell of pyridine still remains. Although this plan may in many cases do all that is required, there are other works so situated where the water, even after the elimination of the sulphuretted hydrogen by filtration through oxide of iron, is likely, for the reason already stated, to cause nuisance if allowed to leave the works. Among some of the methods for dealing with this offensive effluent from this class of works, are the following: Returning it to the ammonia still, and so dealing with it along with the spent ammoniacal liquor. This plan is frequently adopted now. It is, however, objected to at some works, where the liquor is weak to start with, as it somewhat reduces the working power of the still by diluting the liquor entering. This can be met by erecting a small special still for distilling water alone. In small gas-works, where the furnaces are not on the most approved regenerative principle, it can be evaporated in the ash-pits; the offensive steam passing up through the fires, and the noxious gases being so burnt. When sulphate plants are attached to gas-works, the water may be used in the scrubbers; the sulphuretted hydrogen, &c., passing to purifiers. The coal carbonizing works in the district were very actively employed last year, although the price of sulphate of ammonia was so low. The enhanced price of benzol latterly has, however, been a considerable help. There are six works of this class registered. During the year, much was accomplished in the way of improving the plants registered under this schedule. Tar is distilled in 23 works in the district. The methods in use for dealing with the two sources of nuisance arising from tar distillation—viz., gases and vapours escaping from worm ends of condensers, and the cooling of pitch—are pretty much as described in previous reports, except that improvements have been introduced on one of the approved lines in several works, especially in the erection of properly constructed pitch coolers and bays, and in the drawing of the gases and vapours from the pitch coolers to condensers, and finally to purifiers or to fires.

Dr. A. C. Fryer, reporting upon the south-west district of England and South Wales, makes some interesting remarks on ammonium chloride and sulphate works, of which there are 72 registered in that area. Some notable improvements were effected in the plant last year. In two places continuous stills were put up; in two more, new saturators were erected; in others, old plants were renewed and the oxide purifiers enlarged. In his previous report, Dr. Fryer referred to the difficulty experienced in operating the Claus sulphur kiln and chambers at one works, so as to avoid causing nuisance to the inhabitants of adjacent houses. To meet the wishes of the Inspectors, the Directors of the Gas Company concerned sanctioned the removal of the plant to another part of their property. The Claus sulphur chambers are not always free from the escape of noxious fumes. The Engineer of the Bournemouth Gas-Works (Mr. W. J. Fuller, F.I.C.) finds it best to construct these chambers of brick set in cement, and to stop all leaks with clay. Dr. Fryer deals at some length with the arrangements devised by Mr. Wilton, of Beckton, and Mr. C. Stafford Ellery, of Bath, for the mechanical removal of the salts to the drainer. Mr. Wilton's is giving great satisfaction; while by Mr. Ellery's the life of the saturator is prolonged, labour is reduced, and the colour of the salt is improved. Three new works were registered during the year for the manufacture of sulphate; each plant being provided with an oxide of iron purifier for the absorption of the sulphuretted hydrogen. The total quantity of ammoniacal compounds produced during the year amounts to 8070 tons, calculated as ammonium sulphate. Dr. Fryer says that the removal of the water from the condensing apparatus belonging to sulphate of ammonia plants should be taken when the gases are the hottest, otherwise sulphuretted hydrogen may be carried away in solution into the town sewers, to be again liberated and possibly find its way into dwelling-houses. It has been estimated that when the gases are drawn off at the cooler end, they may carry away as much as 5 per cent. of the sulphuretted hydrogen in solution. During the past year, this desirable alteration was effected in seven works. The distillation of tar is carried on at ten works in this district. The free gases which escape from the condensers of the stills contain sulphuretted hydrogen, particularly at the beginning and end of the operation, and some light hydrocarbon vapours. In four cases these gases are led away and consumed in a fire—care being taken to have a water-seal introduced between the worm end and the furnace, to prevent firing-back; or the last few yards of the pipe as it approaches the fire is reduced in size. At all the other works the gases have been led to beds of oxide of iron, in which the sulphuretted hydrogen is decomposed. At each works a closed vessel is provided, in which the pitch is allowed to cool to a certain extent before flowing out into the bay.

Mr. F. Napier Sutton reports at some length on the sulphate of ammonia works in the district comprising the east and south-east of England. During the past year, 83 works were in operation for the manufacture of ammoniacal compounds derived from gas liquor. Sulphate of ammonia is produced in every case; but in a few instances other products are manufactured, including carbonate and nitrate of ammonia, liquid (refined) and anhydrous ammonia. Of the total number of works, 67 belong to gas companies, yielding 74·4 per cent. of the ammonia compounds made in the district. The total quantity of ammoniacal products manufactured during the year 1895 amounted to 42,824 tons, calculated as sulphate. This is the largest amount yet produced; and is an increase of 2480 tons on the quantity made in the district in 1894. One new works was registered—a very small provincial undertaking. The plant is continuous in principle; and the foul gases are passed to the crude coal-gas main, and treated in the ordinary purification plant. Some important alterations were made in the treatment of the foul gases at several works, in consequence of the

pressure put upon them with a view to the discontinuance of the combustion method. Treatment of the sulphuretted hydrogen by some approved plan is now in use at six works, at which the foul gases were burnt and the sulphurous acid allowed to escape. Two of these are important Metropolitan works. One of these Companies possesses two sulphate works, and the sulphuretted hydrogen from one of these is now passed by a 5-inch underground main three-quarters of a mile in length to a sulphuric acid works belonging to a private firm, where it is utilized for sulphuric acid manufacture. This plan was quite experimental in character, as no other instance of sending the gas so far for this purpose was known to exist. However, it has proved perfectly successful. It was thought that some means of propulsion would be required; and an exhaust-engine was therefore put down at the gas-works, and was used for some time. But it has since been found that the saturator pressure is quite sufficient; and the gases are now driven forward by this power alone. It is promised that the gases produced at the other sulphate works belonging to the Company shall be treated by some approved method during the current year.

The Claus sulphur-recovery process was in use at six works last year with varying good results. Duplicate plant is employed at some works; making a total of nine sets of plant. Where the process is intelligently controlled, very excellent results have been obtained; but in some cases the process is apparently regarded as entirely automatic, requiring little or no control. This has led to the waste of sulphur by wrong adjustment of the air supply to sulphuretted hydrogen going into the kiln—sulphurous acid or sulphuretted hydrogen in large quantities passing away to the catch appliances for dealing with the residual gases. The general tendency in such cases is towards the use of an excessive quantity of air. The acid gases then frequently pass the limestone tower without proper neutralization, and the oxide in the catch purifier is permanently damaged. With a very little systematic care and attention, this should not occur. Oxide purification is used at 48 of the works, for the treatment of the sulphuretted hydrogen evolved; and the quantity so treated amounts to 9·9 per cent. This method is chiefly in use at the smaller works; but it was adopted during the past year at two or three works of considerable size, and with success. At one of these, upwards of 800 tons of sulphate were made during the year. Two large open purifiers are employed, each 32 ft. by 16 ft. by 6 ft., and holding 2046 cubic feet of oxide. Schwab's method of intermittent revivification by downward draught is practised; each purifier being fouled and put out of use for revivification once every shift. The gas was originally passed into each purifier alternately for periods of twelve hours; but on revivification too great heat resulted from the chemical action, and the gas was only turned on for periods of six hours. During the twelve months' work, each purifier was recharged four times—roughly once a quarter; that is to say, 100 tons of sulphate were made for each purifier fouled. The bottom layer of oxide comes out exceedingly hard and dense, and highly charged with sulphur; but no excessive back-pressure was observed. A sample of the oxide from the bottom, tested at 70·5 per cent. of sulphur, or 73·9 per cent. on the dry sample—a truly extraordinary result. Treatment of the foul gases by oxide was adopted at two other works at which the combustion method had hitherto been used. The make of sulphate in each case was close upon 200 tons annually. At the larger of these two works, Schwab's plan of intermittent revivification has been practised with favourable results. Experiments in revivification by direct air supply to the purifiers while in use were carried on throughout the year at one works in this district. Two purifiers exist, each 15 ft. by 12 ft., with oxide in two layers of 4 feet total depth, worked alternately. The Manager of the works reports as follows:—

> With regard to revivification of the purifiers *in situ*, we started to introduce air by means of a steam-jet at the inlet to the condensing plant in January, 1895. We did not get much benefit from this; our purifiers still requiring to be changed after ten to twelve full days' working, chiefly due to caking of the oxide on the bottom tray causing back-pressure. At the beginning of July, 1895, on your advice, we altered the position of introduction of air to the outlet of the last scrubber—that is, some 30 feet before the inlet of the foul gases to the purifier. After this alteration, the first purifier we had at work went 35 days without being changed; while the back-pressure was never excessive. The oxide before going into the purifier, calculated on the wet basis, contained 45 per cent. of sulphur. We introduced from 1000 to 1200 cubic feet of air per 24 hours while extracting the ammonia from 18 to 19 tons of 9 to 10 oz. liquor.

Mr. Sutton remarked that a similar experience to the above was recorded in the last report, where trial had been made of the plan advocated by Mr. F. G. Dexter, of Winchester, of using air and steam injection into purifiers for revivification *in situ*. He says the steam certainly appears to be a most useful agent in re-supplying such moisture as is driven off from the oxide by the heat of chemical action, and thereby checking the excessive development of heat as well as caking of the oxide. Further experience of the system will doubtless lead to much advantage in prolonging the life of the purifiers, and reducing the labour and expense of renewal. Use of the hydraulic main and gas purification plant for the foul saturator gas was made at four works—an increase of two on the number using this means of disposal in 1894. Where excessive purifying plant exists, it is, perhaps, a convenient method. Many alterations and improvements were carried out at various works. Some plants were entirely remodelled; while others which were defective were brought to a high state of efficiency. The continuous distillation process superseded the intermittent at several works; and the large proportion of 96 per cent. of the liquor treated in the district is now so distilled. A complaint of serious nuisance arising from the manufacture of sulphate carried on at one gas-works was made in July. Mr. Sutton instituted careful inquiry and inspection in company with the Medical Officer of Health for the district; but he came to the conclusion that the plant was blameless, and that the nuisance complained of had no origin at the gas-works. The number of works at which tar distillation is carried on remains as before—118 stills continuing to be employed at 17 works. No change has to be reported in the plant employed at the larger and better equipped works for treating the gases and fumes from the condensing worms and pitch coolers. These may now all be considered to meet the requirements of the Act. At the smaller works, some advance has been made; but in some instances much still remains to be done to bring them into line with the general standard of efficiency. Mr. Lennard's two continuous stills continue to work with the utmost regularity and success; and all the tar treated at the London works belonging to his firm has been distilled by this process.

Mr. W. S. Curphey, F.I.C., F.C.S., as usual, reports upon Scotland. The number of sulphate of ammonia works in his district is 64—an increase of three as compared with 1894; and the production of sulphate and other salts shows a large increase over the figures for the preceding year. This is in part due to an increase in gas liquor works; but chiefly to considerable increases in works where shale is carbonized for the manufacture of paraffin products, and in those where products are recovered from blast-furnace gases. The ammoniacal liquor resulting from the treatment of blast-furnace gases consists chiefly of carbonate of ammonia, and is practically free from sulphides; so that the question of dealing with sulphuretted hydrogen in connection with the manufacture of sulphate of ammonia from it is not an important one. In shale and gas liquor works, different conditions exist; and much sulphuretted hydrogen is present in the waste gases. In the shale works, the system generally adopted is to lead the vapours from the sulphate-house to the shale retorts, where steam is required to assist in the distillation of the shale. In this way, the steam present is utilized, and the sulphur compounds pass through the processes of cooling and scrubbing, by which the crude oil and ammonia are removed from the products of distillation. The residue remaining from these operations consists of combustible gases, and is used as fuel. It is with these gases that most of the sulphur from the ammonia department passes away, and, being burned with them, eventually escapes into the air as sulphurous acid. In gas liquor works three methods of dealing with the waste gases are in use—viz., absorption in oxide of iron purifiers, burning, and precipitation as sulphide of iron by means of copperas and lime. In 21 works, oxide of iron purifiers were used; in eight, burning is still resorted to; and in three, purification by precipitation is employed. There are 43 works for the distillation of tar, as compared with 39 in 1894. There are two sources of possible offence during the distillation of tar—viz., the gases leaving the end of the condenser during distillation; and the fumes rising from the hot pitch at the end of the distillation. The condenser gases are dealt with in one of three different ways—*i.e.*, burned, absorbed in lime, or absorbed in oxide of iron. The method of burning is that most frequently practised; about one-half of the total number of works being provided with arrangements for this purpose. In fourteen works, lime purifiers are used for the absorption of the sulphur compounds present. In six works, the gases are mixed with the waste gases coming from the sulphate of ammonia plant; the whole being then led to an oxide of iron purifier. These methods of absorption work satisfactorily; but they have been adopted only in the smaller works. In the larger works destruction by burning prevails.

STEAM ROLLING AND GAS AND WATER MAINS.

At the recent Annual Meeting of the Association of Municipal and County Engineers at Brighton—Mr. F. J. C. May, Assoc.M.Inst.C.E., the Borough Engineer of Brighton (the President), in the chair—a discussion took place on the effect of steam-rolling on gas and water mains in the public streets, and the liability of local authorities for any damage thereto.

Mr. E. P. Hooley, Assoc.M.Inst.C.E., the County Surveyor of Nottingham, in a paper on "Steam-Rolling," contended that, with the present use of traction-engines, and large boilers, &c., constantly carried over the roads, drains and pipes that might be damaged by a steam-roller would be equally likely to be injured by these other heavy weights; and the number of shallow drains in country places must in time be gradually altered to suit the needs of an ever-increasing population. All new drains and mains constructed and laid under the roads in Nottinghamshire had to be put in in accordance with the following requirements:—

> When road material or foundation is taken out, it shall be properly sorted, and any portion that may be soft or wet shall be entirely removed from the roads. The trench shall be re-filled with as much of the dry material as the County Surveyor shall consider fit for the purpose: Provided always that the foundation of the road shall be made up with 4 inches of hard dry core, cinders, or rammel, with a final coat, 4 inches thick, of new good sound metalling, similar in character to that of the existing road. As each layer of the new filling-in and road surface is made, it shall be thoroughly well rammed. Should any unevenness afterwards occur, the road surface shall be made good with approved sound road material. Pipes and drains laid beneath any road under the jurisdiction of the County Council shall, if within 3 feet of the surface of the road, be covered with at least 6 inches of concrete surrounding the pipes or drains, or the pipes or drains shall be constructed of iron. It must be clearly understood that all pipes and drains shall be laid so as to allow a steam-roller being used at any time over same; and the Council shall be held free, in case of any accident happening to the pipes or drains—the cost of re-instating any pipe or drain that may be broken or damaged being borne by the authority, company, or persons laying or owning the pipes or drains.

The few drains that had been damaged in Nottingham had usually been those that really required abolishing by reason of their very bad condition, and should never have been allowed to exist.

Mr. W. Weaver said he proposed to touch upon a question not dealt with in the paper—viz., that of liability for damage to gas and water mains. It struck him that surveyors throughout the country, including the Metropolis, were placed in a somewhat difficult position with regard to steam-rolling. Anyone using a steam-roller was liable for the damage done by that roller to gas or water mains, unless he could prove that the pipe damaged had been improperly laid. This was a very difficult thing to do. If the Company gave evidence to the effect that the pipe was properly laid, it was a very hard matter for the local authority to prove it was otherwise. What he apprehended was that some day or other there would be a serious catastrophe. There would be a leakage of gas, resulting from a fracture of the mains, which would blow up two or three houses, and cause several deaths; and there would be a big bill to pay. Then this question of liability would be brought

before them in a manner which would be very unpleasant. Mr. Hooley gave preference to a 12½-ton roller. In London, the 10-ton roller was pretty generally employed, owing to the difficulties they had with gas and water mains. He used to have a 15-ton and three 10-ton rollers in Kensington. After the six days' fight his Vestry had with The Gaslight and Coke Company, when the question of liability was settled in the manner he had indicated, he dropped the 15-ton roller—especially as it was nearly worn out (laughter)—and went on using the 10-ton rollers. He ventured to think that a roller of the latter weight made virtually as good a road, and it certainly got through as much work, as the 15-ton roller.

Mr. A. T. DAVIS agreed with Mr. Weaver that a 10-ton roller was all that was necessary; and he was pleased to say he had never had a case of damage to a gas or water main.

Mr. LOWE said he had had 35 years' experience of steam-rolling, and had not met with any difficulties from the fracture of gas or water mains.

Mr. W. BROOKES said that when he was in Richmond he was always smashing gas pipes with the steam-roller, and having little explosions in the roadway, so that people wanted him to give it up, and have no rolling at all.

Mr. BLAIR said they all admitted that broken pipes and anything of that nature must be made good by the authority using the roller; and Mr. Hooley said the Nottinghamshire County Council imposed obligations upon people laying pipes in the roads to give an indemnity to the county. He (Mr. Blair) would like to know whether the County Council had any statutory authority for imposing such conditions. As far as he knew, the statutory gas and water companies could resist the imposition of such a condition. They were authorized by their statutes to lay mains in roads; and there was no power to compel them to put in concrete, as required in Nottinghamshire.

Mr. HUNT said the liability for broken pipes was of very great importance to country surveyors. In the Dorchester district, it was a cause of constant complaint. There should be some regulation as to the reasonable depth for laying gas and water mains; otherwise it was imposing a great hardship upon the local authority to repair damaged pipes.

The PRESIDENT, in closing the discussion, said they had one 15-ton and three 10-ton rollers at Brighton; but they only used the 15-ton roller where there were no gas and water mains. It would be within the recollection of some members that Brighton got into a difficulty owing to an explosion of gas which was attributed to a steam-roller—the roller having passed over the road the day before the explosion. The action was tried in the Courts; and the Corporation had to "pay the piper." Since then, they had been debarred from using the 15-ton roller in the streets of the town, and only employed it in the suburbs, and on new roads where there were no pipes.

THE QUESTION OF CHARGING DIFFERENTIAL PRICES AT DUKINFIELD.

At the Meeting of the Dukinfield District Council on Monday last week, the minutes of the proceedings of the Gas Committee during the month ending at that date were presented. They contained a report by the Engineer and Manager (Mr. Harrison Veevers) on the subject of charging differential prices for gas used for lighting and heating purposes, prepared in compliance with a request made to him by the Committee early in the year. The question of supplying gas at a lower rate per 1000 cubic feet when used for heating purposes appeared, he said, at first sight, a simple one. It was argued that, as the gas-works were large enough to supply a greater quantity of gas, particularly in the daytime, it might be advantageous to sell it at a lower rate for other purposes than lighting. He endeavoured to show the fallacy of this argument. This he did, as follows: "In the first place, it would not be right to apply the principle at Dukinfield, because no part of the profits of the Gas Department is devoted to a reduction of the rates, so that the consumers got the benefit of any reduction of price as they do the disadvantage of any addition. If, therefore, gas is sold at a lower rate to one class of consumers—for example, users of gas engines, gas-stoves, or cookers—it must be at the expense of those who use it solely for lighting purposes. I do not see the equity of reducing the price to what would be comparatively a small consumption at the expense of those using a large quantity. The case would be analagous to a flour dealer charging a less price for the same quality of flour to a customer who intended to make pastry than if he intended to make bread. In the second place, I question if it would be legal to vary the price of gas as fixed by the Act of 1877, sections 42 and 43, where the maximum price is not to exceed 5s. per 1000 feet, with reductions, as between large and small consumers, of from 1d. to 5d. per 1000 feet, according to the amount of the quarterly consumption. To reduce the price for any reason or purpose would not accord with the orders of the Act of Parliament." Mr. Veevers went on to show that there are other, though perhaps minor, objections to the proposal. One is that an additional meter, and in many cases another service-pipe, would have to be provided to register and supply the gas to be used for heat and power. These would entail much more work in the meter inspection department, and a great additional expense to the finances of the Gas Committee. Another objection is that there would be a liability of consumers, inadvertently or otherwise, connecting the two sets of fittings in the premises having the dual supply, so that gas for lighting purposes might only pass through and be registered, wholly or in part, by the meter supplying the lower-priced gas. He said it would be difficult, if not impossible, to prevent this; and to have periodical and thorough examinations of the whole of the fittings in a residence would entail considerable expense in the cost of inspection. He concluded by saying that the Committee now encourage the use of gas by not charging meter-rents to small consumers, and by the provision of prepayment meters; but he does not think it would be equitable or legal to reduce the price of gas as suggested, when it is to be consumed for any other purposes than for lighting.

SOWERBY BRIDGE GAS-WORKS EXTENSIONS.

Two alternative proposals for the construction of a new holder at the Sowerby Bridge Gas-Works have provoked a great deal of heated discussion at the meeting of the District Council; and in order to settle the matter, the members wisely determined to consult an expert. They accordingly sought the opinion of Mr. G. E. Stevenson, of Manchester; and his report has been published. The nature of the two proposals is briefly stated in the report thus: (1) That a new gasholder should be erected in the existing tank; the tank, however, being raised to the same level as those of the other two holders. (2) That a tank of larger diameter should be constructed in place of the existing one, but removed further back from the yard, so as to occupy a strip of ground between the present tank and the river wall, and that a holder of correspondingly larger diameter should be erected in it. Owing, says Mr. Stevenson, to the fact that the width of space between the present two working gas-holders is limited, the difference in diameter of the two proposed holders could not exceed 5 feet. That which could be placed in the existing tank would be 65 feet in diameter; and the one which would be put down if a new tank were built, would be 70 feet in diameter. Both holders would have three lifts each, 23 feet deep; and the difference in the capacity of the two would be 30,000 cubic feet. The total storage capacity after the extension was made would be 700,000 cubic feet with the smaller, and 730,000 cubic feet with the larger holder. The Committee have decided upon a holder of the Gadd and Mason type, and have obtained tenders for the work from Messrs. R. and J. Dempster and other contractors. The difference in the price asked by Messrs. Dempster for a gasholder 65 feet in diameter and one 70 feet in diameter is £790. The total extra cost of putting down the larger holder would be from £1500 to £1600; and considering that the difference in capacity is so small and the yard space gained very insignificant, Mr. Stevenson pronounces in favour of the smaller holder. He is largely influenced by consideration of the risk which would be incurred in making a deep excavation in such close proximity to the other holders and to the river wall, and the fact that difficulties might occur which would cause great expense. He also considers that the smaller holder will give ample additional storage room for the next three years, as it will raise the total capacity to 700,000 cubic feet, which is just 25 per cent. in excess of the greatest day's consumption. The report further suggests the removal of two new purifiers to the strip of land behind the new holder; the reconstruction of the retort-settings on the regenerator system; and the extension of the retort-house by 50 or 60 feet, by which the manufacturing power would be increased to 900,000 cubic feet. A resolution approving of the smaller scheme has been unanimously passed by the Gas Committee, and confirmed by the Council.

SUGGESTED IMPROVEMENTS AT THE LEIGH (LANCS) GAS-WORKS.

Report by Mr. T. Newbigging, M.Inst.C.E.

At the request of the Gas Committee of the Leigh (Lancs.) District Council, Mr. T. Newbigging, M.Inst.C.E., has lately inspected their works and reported on their condition and on the prospects of gas extension throughout the district. The site has an area of 19,783½ square yards, or rather more than 4 statute acres; but as the works have grown gradually, it is not occupied so advantageously as it might have been. Without undue crowding, however, Mr. Newbigging thinks it will be possible to produce and deal with 2 million cubic feet of gas per day, or nearly three times the present maximum daily production. The sale of gas has doubled in ten years; and assuming an equal expansion in the future, with day consumption, the ground will suffice for probably 15 to 18 years. The works are in the centre of the town—an arrangement which has its drawbacks; and the suggestion is made whether a new site could be obtained, reserving the present one for storage purposes. But this would involve a sacrifice of capital and a lowering of profits, and probably prevent a reduction in price over a series of years.

Going through the works in detail, Mr. Newbigging finds the covered coal storage room very restricted—being equal to only 15 days' maximum usage, whereas a six weeks' mid-winter stock is considered the safe minimum. It is suggested that a further portion of the yard should be covered in with a light roof. The present gas-producing power is 86 mouthpieces on the horizontal, and 98 on the inclined retorts. The former (56 of which are of small size) are capable of yielding, on the average, 5500 cubic feet, and the latter 7500 cubic feet per mouthpiece per day—equal to (say) 1,200,000 cubic feet maximum. The Engineer (Mr. A. T. Fletcher) proposes to raise the lower portion of the retort-house by 10 feet, and to increase the number of inclined retorts by 98, taking the place of the horizontal retorts. By so doing, the producing capabilities will be augmented by 25 per cent., and will stand at about 1,500,000 cubic feet maximum per day of 24 hours, which is more than double the present highest make. He proposes, however, in the first instance, to build along one side of the house only one stack, containing 49 mouthpieces; leaving the erection of the stack on the other side till a future time. Mr. Newbigging approves of this extension. He remarks that, although the direct economy of the inclined as compared with the horizontal retorts is not great, there is an actual saving of 1s. per ton of coal carbonized; and he points out that the ease with which they can be manipulated affords an advantage in the face of threatened or actual labour disputes. The condensing, exhausting, and scrubbing plant is adequate; but the washer is scarcely large enough. The purifiers, four in number and each 18 feet square, are too small. The superficial area of each vessel is only 324 square feet; whereas, for the economical and efficient purification of the maximum daily make of 700,000 cubic feet of gas, the area required is not less than 420 square feet. An immediate extension in this department of the works is therefore required; and Mr. Newbigging recommends the addition of two new 18-feet purifiers to the present set, making six—the first four to be used with oxide, and the other two with lime, which is not at present employed. The

station meter is of sufficient capacity to serve for some time; but a second governor is needed. There are three gasholders, which afford storage for 730,000 cubic feet—about a maximum day's output. They will shortly have to be enlarged by the addition of a lift to one or more of them, or be supplemented by another holder, for which there is space. With a lift added to each of the larger holders, the smaller one could be removed. With regard to the sulphate plant, Mr. Newbigging is satisfied with the yield of 28·45 lbs. per ton of coal; but he thinks this could be improved upon, and the cost of production economized, by having a larger still. The Committee appear to be disposed to undertake the distillation of their tar. Mr. Newbigging encourages the project, providing the process is conducted with skill and assiduity; otherwise it will be unsuccessful, and therefore should not be taken up. The unaccounted-for gas is 6·68 per cent. of the make—a not unsatisfactory figure, considering the subsidences in the ground; and the mains generally are of ample size. The average price—2s. 7·44d. per 1000 cubic feet—is reasonably low, seeing that the cost of the public lighting is not charged, nor are meter-rents. Mr. Newbigging is opposed to the policy of not charging for the street lighting, chiefly on the ground that it gives the non-consumer of gas an advantage over the consumer. As to the electric light, he questions very much if it would pay the Council to introduce it into Leigh; but, whether they do so or not, their true policy is, he says, to maintain their gas-works in a state of efficiency—enlarging and improving them whenever necessary. He points out that, even in places where the light has been introduced, it is found that the demand for gas suffers little or no diminution.

He concludes by saying that, speaking of the gas-works generally, they afford distinct evidence of good management, both from an engineering and an administrative point of view. He adds that they constitute a valuable asset in the hands of the ratepayers, and it has given him considerable satisfaction to inspect and report upon them.

WELLINGTON (SOMERSET) GAS COMPANY.

At the recent Annual Meeting of this Company, the Manager and Secretary (Mr. P. Thomas) presented his report on the working of the undertaking during the year ended June 24. It showed a balance of £772, which, with £380 spent on new mains and £173 on alterations to the Manager's house, made a total of £1325 in round figures; while the reduction of 3d. per 1000 cubic feet as from September last represented an additional £138. The whole of the plant is in excellent condition; and, with a few small exceptions, it is equal to a 25 per cent. increase on the present production. Mr. Thomas also presented an analysis of the working for the year, together with a comparative statement for the year 1894-5; giving the carbonizing operations in detail. The average cost of coal per ton in the year just closed was 19s. 2¼d., as compared with 19s. 8d.; the quantity carbonized was 1350 tons 8 cwts., as against 1149 tons 8 cwts.; the gas made per ton, 10,370 cubic feet, as against 10,212 cubic feet; gas sold, 9613 cubic feet, as against 9476 cubic feet; gas unaccounted for, 6·58 per cent. on the make, as compared with 6·26 per cent. The paid-up share capital (£8500) is £606 19s. 1¾d. per million cubic feet of gas made, as compared with £724 5s. 4d. in 1894-5; do. per ton of coal used, £6 5s. 11d., as against £7 7s. 11¾d.; do. per 1000 cubic feet of gas made, 12s. 1¾d., as compared with 14s. 5¾d.; do. sold, 13s. 1d., as against 15s. 9¼d. The gas and meter rental last year amounted to £2328, as compared with £2079 in 1894-5. The Directors have further reduced the price of gas from 3s. 11d. to 3s. 9d. per 1000 cubic feet; and have raised Mr. Thomas's salary by £20 per annum.

Sales of Shares.—On Monday, last week, Mr. Alfred Richards sold at the Mart, Tokenhouse Yard, E.C., 400 fully-paid £10 shares in the Southend Gas Company. The last dividend on similar shares was 7 per cent. The following prices per share were obtained: 5, £17 5s.; 20, £17 2s. 6d.; 120, £17 2s. 6d.; 275, £17. The total amount realized was £6816 5s.——Sixteen £10 fully-paid ordinary shares in the Bridport Gas Company, Limited, bearing a dividend of 8 per cent., were sold by auction locally last Wednesday, and the prices realized were from £15 5s. to £15 8s. per share. This is the highest figure ever paid for this stock.

The Local Government Board and the Portsmouth Water-Works Purchase Question.—The Local Government Board have informed the Portsmouth Corporation that, in the event of their sanctioning a loan for the acquisition of the water-works, the repayment of principal and interest would have to be completed in a period of sixty years. The basis of the calculations which have been laid before the Council was the borrowing of the million or so of money required for a period of 70 or 80 years; and it was on this assumption that the estimate was arrived at, setting forth an immediate margin of profit, increasing year by year, on the working of the undertaking. If the money is to be borrowed for 60 years only, the utmost economy, it is stated by a local paper, could not bring the deficit for the first year much below £3000; while it would be four or five years before the income rose to the level of the expenditure.

Incandescent Gas-Lamps *v.* Electric Lighting for Dorking.—The Dorking District Council appear to be anxious to have incandescent gas lighting in their streets; but, according to the Chairman (Mr. H. J. Chaldecott), the Gas Company decline to put up the mantles and to move in the matter; urging that it is the duty of the Council to do it. At the last meeting of the Council, Mr. Chaldecott drew attention to the fact that at Reigate the Gas Company had met the Corporation by putting up the mantles, &c., at a price agreed upon, which seemed to him to be very much more satisfactory. He ventured to think they might again approach the Dorking Company, and see if they could not come to some understanding. The Council feel that some definite steps should be taken to improve the lighting of the streets; and if they are unable to come to any satisfactory arrangement with the Gas Company, it is proposed that they should turn to electric lighting.

BIRMINGHAM CORPORATION WATER SUPPLY.

Additional Works—Annual Accounts—The Welsh Scheme.

At the Meeting of the Birmingham City Council on Tuesday last—the Lord Mayor (Mr. J. Smith) presiding—the Water Committee submitted a report dealing with several important matters.

In the first place, the report stated that it is proposed, on the advice of the Consulting Engineer (Mr. Davey), to add a new engine to the plant at the Aston station, capable of pumping 3 million gallons per day. The Committee have accordingly entered into contracts for the engine at £1025; for steam pipes and connections, at £789; and for boilers, at £1200. It is also intended to make certain changes in connection with the large reservoir at Aston, when it will constitute an important adjunct to the storage of the department, whereas, since the discontinuance of taking water from the Tame in 1872, it has been chiefly used for condensing and feed purposes in connection with the Aston engines.

The statistical statements appended to the report show that further economy has been effected in the consumption of water; and this notwithstanding the fact that the estimated average population in supply during the period has increased by 13,402, and that the quantity of water distributed on measured supplies has also augmented very materially. The estimated saving per head per day in the consumption for domestic purposes and for the extinction of fire, and waste, has been 0·82 gallon, which represents on the year a total of 197,758,000 gallons; and if this large saving had not taken place—or, in other words, if the consumption for domestic purposes had continued at the same rate as in the previous year—the average daily consumption would have been increased to 16·46 million gallons per day, against the actual 15·917 million gallons. The Committee attribute the saving to a large extent to the more strenuous measures taken for the prevention of waste; and in consequence a considerable saving has been effected in pumping charges. During the present dry season, however, the resources of the department have been strained to the utmost to cope with the demand, which from May 7 to June 18 averaged about 19 million gallons per day, exceeding the present yield of the sources of supply by nearly 2 million gallons. The deficiency has been made up by drawing upon the storage, which has been reduced between the dates named by over 78 million gallons. As a source of temporary supply pending the arrival of Welsh water, the Committee have, subject to the approval of the Council, made an arrangement with Lieut.-General the Hon. Somerset Calthorpe for the acquisition of the pumping rights at the Perry sinking, Perry Barr—an abandoned trial shaft boring for coal. By the payment of £100, the Corporation will have the power of putting down temporary plant to prove the quantity of water available at the sinking, with the option, within one year of the commencement of the trial, of taking the sinking on a lease for seven years, subject to the right of the Corporation to determine it at six months' notice, should the average daily yield fall below 500,000 gallons or the water become unsatisfactory in quality; the lease to be renewable at the option of the Corporation for a further seven years, subject to the right on the part of the Corporation to determine it during the second seven years at one year's notice, at a fixed rent during the whole of the lease of £750 a year for the water, including a site for the erection of a pumping-station, and £30 a year for the cottages and other buildings already on the land. Mr. Davey estimates that the cost of the plant will be about £3500; and should the experiment be successful, a main to convey the water to Aston will be required.

Referring next to the accounts for the year ended March 31 last, the Committee say that the water-rents show a total increase of 4·56 per cent. over the amount for the previous year. Notwithstanding the increased expenditure in wages through the reduction of workmen's hours, the cost of pumping for the year shows a material reduction, although the total quantity of water pumped is practically the same. This is accounted for by economies which have been effected in the purchase and consumption of coal, and in other ways. The net balance of profit on the year's working is £17,708, as against £12,226 in the preceding year. The profit has been carried to the special water fund, in accordance with the Act of 1892. The special water fund account, including the profit of the year, now amounts to £51,712.

Concerning the progress of the Elan Valley works, the Committee state that the railway is now workable for traffic right through to the highest point to be reached—that is, the site of the Craig Goch dam, a distance of about six miles above the junction with railway No. 1, and nine miles from the junction with the Cambrian Railway Company's line. The total cost of the railways above the Caban dam, and of the highway diversions to March 31, 1896, was £40,338. The excavation on the Brecon side of the Caban reservoir is well advanced; and the Engineer reports that building will probably be commenced on the lowest part of the pit in two or three weeks' time. The excavation for the submerged dam at Careg-ddu has proceeded rapidly, and has been completed at one side. At Pen-y-Gareg the excavation amounts to 38,889 cubic yards; and at this point also building will be commenced during the present summer. A start has been made in the excavation for the dam at Craig Goch reservoir, so that the work at all the reservoirs required for the first instalment of the scheme has been commenced. The heading for the Foel tunnel has been started at both the inlet and outlet ends; the length driven being 495 feet. The open winter has been very favourable for the carrying on of the works; and the lowest number of men shown in the monthly reports as being employed was 926. The number at the end of May was 1174. The total amount expended on the works in the Elan Valley to March 31 was £215,549. In connection with the aqueduct No. 2—Dolau to Knighton—the Committee report that the total length of tunnel driven to June 12 was: On the Dolau tunnel, 5412 feet; and on the Knighton tunnel, 6030 feet. In addition, a total length of 6095 feet of cut-and-cover conduit has been completed, and 1700 feet of syphon have been laid. The total value of the work executed to March 31 was £63,693.

Alderman Lawley Parker first submitted a resolution authorizing the Water Committee to acquire the Perry sinking on the terms set forth in the report. He stated that a great saving in the consumption of water had been effected by the house-to-house visitation. Notwith-

standing the increase in demand for water for trade purposes during last year, the erection of 2845 new houses, and an increase of 60,000 in the population, the water consumed in 1896 was something like a million gallons per day less than in 1891. The Committee could see their way to a further saving of from ½ to ¾ million gallons of water in connection with changes at Aston, whereby water previously used for condensing would be available for distribution. A little more could be done, but not much. In the meantime, they had been passing through a drought that had been more serious in its effects than any within the experience of the department; the reservoirs being lower than they had any record of. In April they had 550 million gallons in store; but on July 1 this had gone down to 420 millions. So serious did the Consulting Engineer regard the position, that he came to Birmingham the previous day, and, impressing upon him (Alderman Parker) that he did not think they were very far off a water famine, urged him to do all he possibly could to bring to the knowledge of consumers the necessity for the greatest economy being exercised. In the six or seven years that would expire before the Welsh water was available, they would have to find water for an additional 70,000 or 80,000 persons, that would amount to 1¾ million gallons more per day; and consequently it was absolutely necessary to find an additional temporary local supply. It was believed that a suitable supply could be obtained from the Perry sinking referred to in the Committee's report, and which Professor Lapworth estimated would yield nearly 1½ million gallons of water per day. The cost of the plant would be about £3000; and of mains, £6000 or £7000.

The resolution, having been seconded, was agreed to.

Alderman PARKER then moved that the report be approved; and in doing so, he made some extended remarks on various matters referred to in the report. Alluding also to the contract for the section of the aqueduct from Elan to Dolau, which was let at £379,000, he said that this exceeded the parliamentary estimate by £60,000, or 16 per cent. This was the first material excess they had had. But another contract had been kept within the estimate; and as the Engineer allowed 15 per cent. for engineer's establishment charges and extras, he assumed that half of this amount would be applied towards the excess referred to. Of course, it remained to be seen whether there were any extras. But Mr. Mansergh had carefully guarded against them; and it was probable they would be extremely small.

After a short discussion, the motion was unanimously carried.

THE ACTION OF OLDHAM WATER ON LEAD.

In the autumn of 1895, a number of cases of suspected lead-poisoning occurred in the district supplied with water by the Oldham Corporation; and there was no other assignable cause than the use of the water as laid on to the houses through ordinary lead service-pipes. In consequence, Dr. Tattersall, the Medical Officer, has made an examination of the water from the various reservoirs, with a view of ascertaining as far as possible on what this plumbo-solvent action depended, and whether the various supplies differed from one another in this respect. It was found that all the waters were more or less acid, although the amount of acid in the worst sample was very slight when compared with many of the moorland water supplies in the West Riding of Yorkshire, notably Sheffield and Wakefield. This acidity is, he feels convinced, due to the action of exposed peaty land, which forms a portion of the gathering-grounds for each of the three series of reservoirs—Piethorn, Denshaw, and Castleshaw. It is worthy of notice that the waters containing the greatest amount of albumenoid ammonia were the most acid; and this albumenoid ammonia is almost certainly derived from the peat. The analysis of the water from the various reservoirs shows that it is exceedingly good, and in every way a most satisfactory supply for the town. The waters were also examined for acidity, with the following results (the acid being reckoned as sulphuric acid, and expressed as such in grains per gallon): Piethorn, 0·35; Hanging Lees, 0·28; New Year's Bridge (Denshaw), 0·49; Castleshaw, 0·56; Strinesdale, 0·63. Several experiments were made by Dr. Tattersall, which showed that the action of the water on lead is due to the acid; and the more acid waters were much more active. He therefore concludes that it is advisable, in order to reduce the plumbo-solvent action of the water, to make every effort to get the water off the peaty gathering-grounds as quickly as possible, and afterwards delay it by frequent settling-tanks and decanting from reservoir to reservoir. Also at the Strinesdale reservoir to expose the water to the vitiated atmosphere as little as possible. Dr. Tattersall denies the value of the tin-washed pipes in preventing the action of water on lead, and urges the advantages of block-tin lined pipes.

THE PROPOSED ACQUISITION OF THE DEAL WATER-WORKS BY THE LOCAL AUTHORITIES.

According to what transpired at the last meeting of the Walmer District Council, there is a hitch in the proceedings relative to the suggested formation of a Joint Board for Deal and Walmer to acquire and manage the undertaking of the Deal Water Company. An agreement was proposed to be entered into between the two authorities, under which each district would control its own supply, but the works would be under the management of Deal, who would supply to Walmer in bulk the quantity of water required at cost price; and Walmer would collect its own rates. There was to be no Joint Committee or Board; but Walmer would have access to the books, for the purpose of finding out whether Deal was in fact supplying the water at cost price. Having obtained this, the Walmer people could make what rate they pleased. The works would be the joint property of each authority, in proportion to the capital found by them in acquiring the undertaking. This is objected to by the Walmer Council, on the ground that they would have no voice in the management of the undertaking; and the Deal Council are to be approached on this point. In the meantime, the latter Council have resolved to promote a Bill to sanction the acquisition of the undertaking by them. The Water Company have submitted the following terms of sale to the Council: (1) A sum to be invested which will produce an income of £1839 12s. per annum from Consols, at the market price current on the date of the agreement for purchase—the sum named being the total amount of the yearly interest payable on the Company's called-up share capital; (2) the par value of the debenture capital, £4575; (3) the amount invested in Consols now standing to the credit of the reserve fund, with the accrued dividends thereon; (4) the balance of the dividend and interest account at the time of the final settlement, in satisfaction of back dividends and prospective value; (5) the stock of pipes, valves, &c., to be taken at a valuation; (6) £500 to be divided among the Directors and the Secretary and Manager, whose services will be no longer required; (7) the usual stipulation that other officers of the Company whose services are not retained shall be compensated; (8) the Company to pay all their debts, and the income, rates, and taxes to be apportioned to the day of settlement; (9) the purchasers to have the balance unexpended of the capital account at the time of the final settlement. The Company will be prepared to accept in lieu of the first item sufficient of the Deal and Walmer Authorities water stock, if such stock should be created, as will produce the same sum with a capital bonus of £10 per cent. added. The amount of such stock to be given would be about £67,452, representing a quotation of £110—the interest to be at the rate of £3 per cent. As against this offer by the Company, the Borough Accountant estimates that the works and undertaking are worth only £48,300.

THE STOURBRIDGE DISTRICT COUNCIL AND THE LOCAL WATER-WORKS.

On the invitation of their Chairman (Mr. Walter Jones), the Stourbridge District Council have recently considered the desirability of acquiring the water undertaking. Mr. Jones said there was a general feeling that the works should become the property of the Council; and he believed the right time had arrived for negotiating the purchase. He had nothing to say against the Company, who ran the risks, and had supplied good water, and plenty of it, but at a very high—he believed excessive—price. He moved that a Committee be appointed to investigate the matter. This was seconded by Mr. Purkis, who agreed that it was desirable that all such monopolies should be in the hands of the ratepayers, and that the present was the right time to enter into negotiations. If the Council made up their minds to purchase, no power on earth could prevent them ultimately doing so. They would, of course, be prepared to give full value for the undertaking. Mr. Nash had no desire to throw cold water on the scheme; but, in his opinion, the question was whether they could secure the undertaking on such terms as would cause it to prove an advantage to the town. He agreed as to the advisability of the purchase, if it could be done without incurring expense in obtaining compulsory powers. Mr. W. B. Collis, who is interested in the water-works, thought that it would be unwise to take action at present; the town being already sufficiently burdened by the obligations in connection with the gas undertaking. If the Council acquired the works, they would have to pay a very large price. Mr. Herbert Collis said that the town had pledged itself to the purchase of the undertaking at public meetings, at which no dissentient voice was heard; and it was only by a casting-vote that a resolution in favour of compulsory powers being secured was lost. He doubted whether the present was the best time for moving in the matter, as the gas loan was not re-arranged last quarter. However, he favoured the appointment of a Committee to make inquiries into the question and to report. Other gentlemen having spoken, the Chairman, in reply, said if the matter were deferred seven years, it would mean that another £20,000 would have to be paid by the Council. He believed that they should either drop the whole thing or go in for compulsory powers. The discussion closed by the passing of an amendment—proposed by Mr. Herbert Collis—that a Committee be appointed to obtain information as to similar undertakings, and as to the basis upon which the Stourbridge works could be secured.

Exhibition of Gas Appliances at Bradford.—An exhibition of gas-cooking ranges, stoves, and other domestic appliances manufactured by Messrs. Fletcher, Russell, and Co., Limited, was held last week at Bradford; the opening ceremony, on Tuesday, being performed by Mr. T. Speight, the Deputy-Chairman of the Corporation Gas Committee. The cookery demonstrations were in the capable hands of Mrs. H. M. Young.

The Proposed Purchase of the West Houghton Gas-Works.—Acting upon the instructions from the General Purposes Committee of the West Houghton District Council, the Clerk to that authority has communicated with the West Houghton Gas Company inquiring if they are willing to sell their undertaking to the Council. The Council are, by resolution, "prepared to purchase, if the works and plant can be secured at a fair and equitable price."

Issue of New Stock of the Harrogate Gas Company.—Last Wednesday week the Directors of the Harrogate Gas Company received tenders for new shares, which, when fully paid up, will be consolidated with the existing "C" stock of the Company. The number of shares on offer was 286; but tenders were received for 1098—representing a money value of £33,888, or an average of nearly £31 per share. The minimum price fixed per share of £10 was £30.

Messrs. Kirkham, Hulett, and Chandler's Washing and Condensing Plant.—The Paris Gas Company have lately ordered, through Messrs. Kirkham, Hulett, and Chandler's agents in that city, fifteen of their "Standard" washer-scrubbers, each for 3½ million cubic feet of gas per diem. The firm have recently erected at the Saltley Gas-Works of the Birmingham Corporation a large washer, of special design, for the recovery of cyanides; and they have other machines in hand for The Gaslight and Coke Company for use in the same connection. Three of Marshall's condensers have been put up at the Coventry Gas-Works.

NOTES FROM SCOTLAND.

From Our Own Correspondent.

Saturday.

I am favoured by Mr. Carlow, of Arbroath, with the notice of the meeting of the North British Association of Gas Managers—the thirty-fifth—which is to be held in the Waterloo Hotel, Edinburgh, on the 22nd and 23rd inst. The meeting place is the same as that in which the Association met in 1891. Mr. A. Yuill, of Alloa, is to preside. A list of the papers to be read is given on another page. They are five in number; and I am pleased to observe that they are of such a work-a-day order. They are subjects with which gas managers meet constantly in the discharge of their ordinary duties; and as such they are particularly appropriate for discussion at a meeting of managers of moderate-sized or small works. If they are efficiently handled, Scotland's standing in the industry will be effectively asserted. It will be observed that none of the managers of the larger works are on the list, for the reason, I suppose, that, with the exception of Mr. Foulis, of Glasgow, who is engaged in the working of his cyanide process, scarcely any of the managers of large works are practically interested in the advanced problems of the day. When all is said, however, the questions of primary importance to gas managers are those which touch them every day, and not those which still are, and which may always remain, in the heavens. Scientific subjects are not neglected in the programme; for Mr. Young's paper, on the permanency of illuminating gas, should bring out some hard thinking from more than one head. I daresay Mr. Young was moved to give the paper on account of the unsatisfactory nature of the discussion on the subject at the Informal Meeting of Gas Managers in April. The paper by Mr. Forbes Waddell, of Forfar, will bring forward the accident he had at his works last November. The subject will be fully before the Association for discussion as to the causes which led to the accident. It is one of great importance to gas managers, as it opens up possibilities in connection with Board of Trade inquiries which are the reverse of pleasant to anticipate. In order that members may approach the question with fully informed minds, it may not be out of place to suggest to them that they should re-read the proceedings at the inquiry, and also Mr. Vernon Harcourt's report. The first is in the "JOURNAL" for Jan. 28 last; and the second, in the "JOURNAL" for March 24 last.

The arbitration proceedings in connection with the Dunfermline gas transfer are to be taken, as I anticipated, in October. They are to begin on Friday, the 9th, and are expected to last at least three days. Mr. William Foulis, of Glasgow, is the Arbitrator nominated by the Corporation; and Mr. H. E. Jones, of London, has been selected by the Gas Company. Mr. Shiress Will, Q.C., is to be Oversman.

The Corporation of Dumfries, in their working of the gas department last year, earned a profit of £2264, to which there was added £437 of balance brought forward. Last year's balance of profit was £515. After paying interest on mortgages and temporary loans, adding £1300 to the sinking fund for redemption of mortgages, and £250 to the reserve fund, there is a balance remaining of £79. The reserve fund now amounts to £1119. A year ago the price of gas was reduced from 3s. 6d. to 3s. 4d. per 1000 cubic feet; and it will remain at this figure for the present. The Manager (Mr. G. Malam) reports, for the year ending May 15, that 6445 tons of coal and 312 tons of blue oil were carbonized, at an average price for both of 14s. 1d. per ton. In the preceding year, 5627 tons of coal and 533 tons of oil were carbonized, at an average cost of 15s. 9d. per ton. The quantity of gas manufactured was 64,723,300 cubic feet, or 10,170 cubic feet per ton, compared with 64,688,100 cubic feet, or 10,501 cubic feet per ton. The quantity of gas sold and used in the works amounted to 61,302,700 cubic feet, or of 9072 cubic feet per ton, as compared with 57,477,450 cubic feet, or 9330 cubic feet per ton. Unaccounted-for gas amounted to 10·79 per cent. The Peebles oil-gas process still continues to work satisfactorily; and to stop complaints of smoky gas, it has been decided to reduce the quantity of oil and increase the quantity and quality of cannel during the current year, and also to fix the illuminating power of the gas at 28 candles.

At the annual meeting of the shareholders of the Galashiels Gas Company, held on Tuesday, it was reported, in addition to what I gave last week, that the value of the works of the Company amounts to £24,533; and that the income was £10,306, of which £8959 was received for gas and £1138 for tar, coke, and lime. The expenditure, including £619 for depreciation, amounted to £8205. Of this, £539 was spent on repairs, £440 on oil, £4166 on coal, and £191 on lime. The Chairman (Mr. P. Sanderson) said that the Directors visited the works the previous week, and found everything in thorough working order. The report just presented they considered very satisfactory, having regard to the state of trade locally. Five years ago there was 5 or 5½ million cubic feet of gas more used in the factories than now; but the decrease was due to the want of night work. House consumption, however, was not decreasing. The oil process was doing very well. The new steel retorts invented and patented by their Manager and Mr. M'Lean were working very satisfactorily; and an order for several of them had been received that morning from Alloa. The Directors' report was adopted.

The annual meeting of the Saltcoats Gas Company was held on the 1st inst. The statement of accounts showed a prosperous year. The progressive increase in the quantity of gas sold indicates both the progress of the town and the increasing use of gas. In 1865-6, it was 2,319,000 cubic feet; in 1875-6, 3,954,200 cubic feet; in 1885-6, 6,486,500 cubic feet; in 1895-6, 12,010,400 cubic feet. As the quantity sold has increased, the price has gone down to 3s. 9d. per 1000 cubic feet. The leakage has been reduced to 8·4 per cent. A dividend of 7½ per cent. was declared; and the price of gas was reduced to 3s. 4d. per 1000 cubic feet. The report of the Manager (Mr. J. N. Myers) showed that a re-adjustment of the conditions of supply to the street-lamps was necessary. The present arrangement, by which the gas is charged at two-thirds of the rate paid by ordinary consumers, is not profitable to the Company. The figure is to be continued at 2s. 6d., on the understanding that certain minor matters can be satisfactorily adjusted. Gas at 3s. 4d. per 1000 feet, no charge for meter-rent, the leakage reduced, and the works maintained in a fair state of efficiency, reflects credit on Mr. Myers, whose services are much appreciated by the Directors.

The shareholders of the Cupar Gas Company held their annual meeting on Thursday. It was reported that the profit for the year was £788, to which there was added a balance of £125 from the previous year; making a total divisible sum of £913. The Directors proposed that the dividends to be paid should be 4 per cent. on the preference stock, and 7½ per cent. on the ordinary stock, which would leave £157 to be carried forward. It was moved by a shareholder that 8 per cent. be paid on the ordinary stock. This led to some discussion; but eventually the resolution to pay 8 per cent. was carried.

At the annual meeting of the Brechin Gaslight Company on Monday, it was reported that the sale of gas had increased by upwards of a million cubic feet during the year. The price was reduced from 4s. 7d. to 4s. 5d. per 1000 cubic feet. The Chairman (Mr. J. Guthrie) made reference to the improved condition of everything connected with the gas-works, and also to the litigation which had been directed against the Company. The latter had been troublesome, and had involved some expenditure; but a valuable principle was established, which he thought was of far more value to the Company than the amount they had paid. There would be an immediate issue of 30 new shares of £10 each to the present shareholders. Offers for these would be taken; and the shares would be allotted to the highest bidders, provided the price was not less than £22 per share. This issue would complete the capital of the Company, as authorized by the Articles of Association. The money was required to pay the cost of the completion of the Witchden tunnel, which had given them a good deal of annoyance in past years, when the Denburn was in flood. The report was adopted. Mr. J. L. Aird, Solicitor, as Town Treasurer, asked whether it was true that the Directors had resolved to refuse access to their works of an inspector or valuator on behalf of the Town Council. The reply was that the Company were, and always had been, perfectly willing to afford the Town Council every facility and opportunity to examine the works and property of the Company, with a view of treating for a transfer of the undertaking; but, as Mr. Aird very well knew, there was an Act of Parliament dealing with the matter, and it behoved the Town Council to comply with the requirements of that Act before they could be in a position to treat with the Company. The Company were quite ready to sell; but they were not prepared to have their premises invaded by appraisers until they were authorized by parties who had at least taken preliminary steps to show that they were in earnest and acting in good faith. That was well replied. The Town Council are not *bonâ fide* in the matter; and until they are, no facilities should be given them.

Among the Gas Companies who have announced their dividends this week are: Crieff, where 5 per cent. and a bonus of 1s. per share has been paid, and the price of gas has been retained at 4s. 2d. per 1000 cubic feet; Alyth, where 6 per cent. has been paid and the price of gas has been reduced from 6s. 3d. to 5s. 10d. per 1000 cubic feet, and a bonus of £5 5s. has been awarded to the Manager, Mr. A. Robertson; Leslie, where 1s. 6d. per share has been paid, £25 has been set aside as the nucleus of a reserve fund, meter-rents are reduced by one-half, and a proposal to convert the Company into a limited liability one has been remitted to the Directors; Ferry-Port-on-Craig, where the price of gas has been reduced from 6s. 3d. to 5s. 10d. per 1000 cubic feet; Newmilns, Ayrshire, where 5 per cent. has been paid; Kirriemuir, where 5 per cent. has been paid; and Kilmalcolm, where 7½ per cent. has been paid, £50 added to the reserve fund, the price of gas reduced from 5s. 5d. to 5s. per 1000 feet, and a scale of liberal discounts adopted.

The Town Council of Inverness on Monday reduced the price of gas from 4s. 2d. to 3s. 9d. per 1000 cubic feet, which is the lowest figure at which gas has been sold in Inverness, and is 1s. 3d. per 1000 cubic feet less than the price two years ago.

On Monday evening, there was an explosion of gas in the house of a miner at Cambuslang. A steam road-roller was at work in front of the house during the day, which damaged the service-pipe; and the gas penetrating into the house, was ignited by the kitchen fire. Several of the inmates were injured.

CURRENT SALES OF GAS PRODUCTS.

LIVERPOOL, *July* 11.

Sulphate of Ammonia.—The quieter tone noticed in the last report has continued throughout the past week; but, with the exception of Leith, where second-hand parcels have been offering, prices have been about maintained. The quotations are £7 17s. 6d. f.o.b. Leith, £7 18s. 9d. Hull, and £8 2s. 6d. Liverpool. The demand has been sufficient to absorb current production; but again it has been mostly to cover speculative sales. Consumers remain indifferent, notwithstanding tempting prices; their attitude being accounted for by the free offering by "bears" in the forward position. There are sellers of July-September delivery at £8 2s. 6d. f.o.b. Leith. Scotch makers are offering October-June at £8 10s.; and dealers are booking orders at even less money.

Nitrate of Soda is a shade firmer; due cargoes being again worth about 7s. 11½d. per cwt. On spot, the quotation for fine quality is 7s. 10½d. to 8s. per cwt.

LONDON, *July* 11.

Tar Products.—Benzols continue to enjoy a good market; and prices have again advanced. It is felt that there is a good deal of speculation going on; but, as there are buyers to the end of the year, it looks as if there was some backbone in the move after all. Solvent naphtha has slightly advanced, doubtless in sympathy. Other products continue much as before. But there is really not much business doing in any of them; and production is now at its minimum. The position and constitution of tar shows itself markedly in the quotations below.

Business has been done during the week at the following rates: Tar, 18s. 6d. to 25s. Pitch, nominal, 32s. 6d. Benzols, 90's, 3s.; 50's, 2s. 6d. Toluol, 2s. Solvent naphtha, 1s. 4d. Crude, 30 per cent., naphtha, 10d. to 11d. Creosote, liquid, 2d.; ordinary, 1½d.

Naphthalene, pressed, £3 5s.; salts, 35s. Cresylic acid, 1s. Carbolic acid, 60's, 2s. 2d. Anthracene, "A," 11d.; "B," 8d. to 9d.

Sulphate of Ammonia is held firmly for £8 2s. 6d. at southern ports; but business has been done at northern ports at £7 17s. 6d. to £8, in each case less 3½ per cent. Nitrate of soda for forward delivery is dearer; but there is no indication of better prices for forward business in sulphate. Gas liquor is offered at 6s. 6d. to 7s. per ton.

COAL TRADE REPORTS.

From Our Own Correspondents.

Lancashire Coal Trade.—The collapse of the Coal Trade Conciliation Board, though not unexpected, necessarily tends to unsettle the immediate outlook. The miners are thoroughly determined to strike, rather than submit to any further reduction in wages; and the restless feeling prevailing among them, in face of the coalowners' intimation that they require a reduction of 10 per cent., is shown by an occurrence at one of the local collieries this week. Here, a dispute connected with the management, and affecting comparatively only a few of the men, was brought before the union officials; but notwithstanding their strong injunction that the men were to remain at work until the matter could be dealt with, the whole of the miners employed at the colliery have come out. So far as the coalowners are concerned, it is more than doubtful whether any attempt will be made to enforce a reduction in wages. Some of the largest collieries in the district have intimated their unwillingness to join a general movement for reducing wages; and it would require at any rate united action for such a movement to have any chance of success. The miners will be content, at least for the present, to maintain wages at the existing level; and it seems not improbable that, rather than force on another conflict, colliery owners will prefer to restrict, as much as possible, the output of the common mines. With regard to gas-making coal, the position remains very much as reported recently; but whether the unsettled outlook just now prevailing in the coal trade will bring about any change with reference to the prices that may be quoted on any further tenders sent in, remains to be seen. So far, they are for the most part based upon excessively low figures; and where contracts have been settled, they represent a giving way of about 6d. per ton on last year's rates. At the pit mouth, best Wigan Arley averages 9s. 6d. to 10s. per ton; and Pemberton four-feet and seconds Arley, 8s. to 8s. 6d. During the past week, the Manchester Corporation have settled their contracts for gas coal for the ensuing season; and the basis on which supplies have been offered to them more than confirms what has been previously reported with regard to the eagerness on the part of colliery owners to secure gascoal contracts, and the low prices they are willing to accept. Although the Manchester Corporation only required 300,000 tons, they had no less than 3 million tons offered to them; and they were able to secure all the supplies they required at exceedingly low rates. As to the actual prices at which they settled their various contracts, no definite figures are at present available, beyond the general statement that in no cases have the Corporation paid more than 9s. per ton for gas coal delivered at their works, and a considerable proportion of the supplies has been obtained at substantially under this figure.

Northern Coal Trade.—There has been an increased demand the last few days for coal, specially for steam and gas coals; and this is partly attributed to the uneasiness of large users, who think that the position in the Midlands is suggestive of a stoppage next month. In regard to gas coals, the chief interest has centred in the contracts for the supply of the Newcastle and Gateshead Gas Company, who use about 185,000 tons per annum. This year tenders have been invited in July, instead of in November; and these tenders were to be for six or for eighteen months at the option of the Company. Although the tenders are not formally ratified at the time of writing, yet practically it may be said that the contracts are determined. The price will be about 6s. 6d. per ton at the works, for best Durham gas coal for delivery over eighteen months from the end of this year. In the gas coke trade, the exports are only very moderate in quantity, but the price is not altered; and as the output is low, the stocks are not large at works near navigable waters.

Scotch Coal Trade.—There is a better tone in the market; but it is more one of expectation than of realization, and is consequent upon the developments of the past week in England. Scotch coal owners, it is understood, would welcome a strike of miners in England, because it would raise prices for them, enable them to clear out stocks, and also put it in their power to increase the wages of their miners. The Scotch miners are not in a position, from the point of view either of finance or organization, to enter upon a strike; and so, if a struggle should take place in England, Scotland is likely to benefit. There is, meanwhile, a good demand, particularly for steam coal, in contemplation of a rise of prices; though as yet it cannot be said that any advance has taken place. The prices quoted are: Main, 5s. 9d. per ton f.o.b. Glasgow; ell, 6s. 3d. to 6s. 6d.; and splint, 6s. 3d. to 6s. 9d. The shipments for the week amounted to 166,215 tons—a decrease of 7409 tons on the quantity in the preceding week, and of 1943 tons when compared with the corresponding week of last year. For the year to date, the total shipments have amounted to 3,663,488 tons—an increase upon the same period of last year of 199,081 tons.

Clay's Anti-Vibratory Fitting for Incandescent Gas-Lamps.—We are asked to mention that the cost of this appliance, which was described last week, is not a few pence, as stated by Alderman Miles at the recent meeting of The Gas Institute, but a few shillings.

The Loughborough Town Council and the Gas-Works.—A Sub-Committee of the Finance Committee of the Loughborough Town Council have been requested to approach the local Gas Company with the view of ascertaining the price at which they will sell their undertaking.

GAS AND WATER COMPANIES' STOCK AND SHARE LIST (see ante, p. 64).

Issue.	Share.	When ex. Dividend.	Dividend or Dividend & Bonus.	NAME.	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.
£			p. c.	GAS COMPANIES.			£ s. d.
590,000	10	15 Apl.	10½	Alliance & Dublin 10 p. c.	25—26	..	4 0 9
100,000	10	„	7½	Do. 7 p. c.	17—18	..	4 3 4
300,000	100	1 July	5	Australian (Sydney) 5% Deb.	108—110*	..	4 10 11
200,000	10	12 June	5	Belgrano (B. Ayres), Limited	10—11	+½	4 10 11
100,000	Stck.	26 June	5	Do. 5 p. c. Deb. Stk	100—103*	..	4 17 1
200,000	5	29 May	6½	Bombay, Limited	7¼—7¾	..	4 3 10
40,000	5	„	6½	Do. New, £4 paid	5¾—6	..	4 6 8
380,000	Stck.	27 Feb.	12	Brentford Consolidated	290—295	..	4 1 4
210,000	„	„	9	Do. New	220—225	..	4 0 0
50,000	„	„	5	Do. 5 p. c. Pref.	—	..	—
159,375	„	12 June	4	Do. 4 p. c. Deb. Stock.	130—134	..	2 19 9
220,000	Stck.	27 Mar.	11	Brighton & Hove Original	237—242	..	4 10 11
208,820	„	„	8	Do. A Ord. Stk.	190—195	..	4 2 0
933,500	Stck.	27 Feb.	5	Bristol, 5 p.c. max.	127—132	..	3 15 9
420,000	20	27 Mar.	11½	British	57—58	+½	3 17 7
50,000	10	12 Mar.	11½	Bromley, Ordinary 10 p. c.	22½—23½	..	4 17 11
71,000	10	„	8½	Do. 7 p. c.	19—20	..	4 5 0
500,000	10	29 Apl.	5	Buenos Ayres (New) Limited	10—11	+½	4 10 11
200,000	100	1 July	6	Do. 6 p. c. Deb.	100—105*	+1½	5 14 3
150,000	20	27 Feb.	8½	Cagliari, Limited	29—31	..	5 6 5
100,000	10	29 May	8	Cape Town & District, Ltd.	17—18	..	4 8 11
50,000	50	2 May	6	Do. 6 p. c. 1st Mort.	58—60	..	5 0 0
550,000	Stck.	15 Apl.	13½	Commercial Old Stock	342—347	..	3 17 8
165,000	„	„	10½	Do. New do.	258—263	..	2 19 10
165,000	„	12 June	4½	Do. 4½ p. c. Deb. do.	146—150	..	3 0 0
800,000	Stck.	12 June	13	Continental Union, Limited.	285—290	..	4 9 8
200,000	„	„	10	Do. 7 p. c. Pref.	220—225	+3	4 8 11
51,620	Stck.	27 Feb.	14	Croydon Com'cial A 10 p. c.	—	..	—
157,500	„	„	11	Do. B 7 p. c.	—	..	—
535,000	Stck.	27 Feb.	5½	Crystal Palace Ord. 5 p.c. Stk	135—140	..	3 15 0
60,000	„	„	5	Do. 5 p. c. Pref.	—	..	—
486,090	10	30 Jan.	11	European, Limited	27—28	..	3 18 6
354,060	10	„	11	Do. £7 10s. paid	18—19	..	4 6 11
5,746,590	Stck.	13 Feb.	12¾	Gaslight & Coke, A, Ordinary	314—319	..	3 19 11
100,000	„	„	4	Do. B, 4 p. c. max.	108—113	..	3 10 9
665,000	„	„	10	Do. C, D, & E, 10 p. c. Pf.	297—302	..	3 6 3
30,000	„	„	5	Do. F, 5 p. c. Prf.	145—150	..	3 6 8
60,000	„	„	7½	Do. G, 7½ p. c. do.	210—215	..	3 9 9
1,300,000	„	„	7	Do. H, 7 p. c. max.	208—213	+3	3 5 9
463,000	„	„	10	Do. J, 10 p. c. Prf.	295—302	..	3 6 8
476,000	„	„	6	Do. K, 6 p. c. Prf.	172—177	..	3 7 10
1,061,150	„	12 June	4	Do. 4 p. c. Deb. Stk.	138—143	..	2 15 11
294,850	„	„	4½	Do. 4½ p. c. do.	148—153	..	2 18 9
908,000	„	„	6	Do. 6 p. c. do.	205—209	..	2 17 5
70,000	10	14 May	6	Hongkong & China, Limited	12¼—13¼	..	4 8 10
3,800,000	Stck.	14 May	12	Imperial Continental	253—258	+2	4 13 0
376,400	100	1 Feb.	4	Do. 4 p. c. Debs. Red.	100—103	..	3 17 8
473,600	Stck.	13 Feb.	3½	Do. 3½ p. c. Deb. Stk	109—111	..	3 3 1
£			p. c.	GAS COMPANIES.			£ s. d.
75,000	5	26 June	6	Malta & Mediterranean, Ltd.	6—6½*	..	4 12 4
560,000	100	1 Apl.	5	Met. of Melbourne, 5 p. c. Deb.	115—118	..	4 4 10
250,000	100	„	4½	Do. 4½ p. c. Debs.	110—112	..	4 0 4
541,920	20	12 June	5	Monte Video, Limited	16½—17½	..	5 14 3
150,000	5	29 May	8	Oriental, Limited	8¼—8¾	..	4 11 5
135,000	5	„	8	Do. New, £4 10s. paid	7¼—7¾	..	4 12 10
15,000	5	„	8	Do. do. 1879, £1 paid	1—2	..	4 0 0
60,000	5	12 Mar.	7	Ottoman, Limited	5—5½	..	6 7 3
166,870	10	—	2	Para, Limited	1½—1¾	..	—
420,000	100	2 Nov.	6	People's Gas } 1st Mtg. Bds.,	105—110	..	5 9 1
500,000	100	1 June	6	of Chicago } and Do.	102—107	..	5 12 1
250,000	10	27 Mar.	8	San Paulo, Limited	13—14	..	5 14 3
500,000	Stck.	13 Feb.	15½	South Metropolitan, A Stock	410—420	+5	3 13 9
1,350,000	„	„	12	Do. B do.	317—322	+2	3 14 6
310,000	„	„	13	Do. C do.	338—343	+1	3 15 9
800,000	„	16 Jan.	5	Do. 5 p. c. Deb. Stk.	175—178	..	2 16 2
60,000	Stck.	12 Mar.	11½	Tottenham & Edmonton, A	250—255	..	4 10 2
60,900	„	„	8½	Do. B	—	..	—
170,380	10	29 May	10	Tuscan, Limited.	13¾—14½	..	6 18 0
149,900	10	1 July	5	Do. 5 p. c. Debs. Red.	98—100*	..	5 0 0

WATER COMPANIES.

746,123	Stck.	26 June	10½	Chelsea, Ordinary	345—350*	+2	2 18 7
150,000	„	„	5	Do. 5 p. c. Pref.	170—175*	..	2 17 1
160,000	„	„	4½	Do. 4½ p. c. Pref. Stk., 1875	—	..	—
175,783	„	27 Mar.	4½	Do. 4½ p. c. Deb. Stock	138—163	..	2 15 2
1,719,514	Stck.	15 Apl.	7	East London, Ordinary	240—245	−1	2 17 2
654,740	„	26 June	4½	Do. 4½ p. c. Deb. Stk.	156—159*	..	2 16 7
100,000	„	„	3	Do. 3 p. c. Deb. Stk.	104—106*	..	2 16 7
700,000	50	12 June	7½	Grand Junction, 10 p.c. max.	123—127	−2½	2 19 0
280,000	Stck.	27 Mar.	4	Do. 4 p. c. Deb. Stk.	149—153	..	2 12 4
708,000	Stck.	13 Feb.	12	Kent	352—357	..	3 7 3
160,000	„	„	7	Do. New, 7 p. c. max.	218—223	+3	3 2 9
1,043,800	100	26 June	7½	Lambeth, 10 p. c. max.	270—275*	..	2 14 6
406,200	100	„	7½	Do. 7½ p. c. max.	227—230*	..	3 5 2
350,000	Stck.	27 Mar.	4	Do. 4 p. c. Deb. Stk.	147—152	..	2 12 8
500,000	100	13 Feb.	12¾	New River, New Shares	439—444	+2	2 17 6
1,000,000	Stck.	30 Jan.	4	Do. 4 p. c. Deb. Stk.	157—160	..	2 10 0
902,300	Stck.	12 June	4	S'thwk & V'xhall, Ordinary	160—165	..	2 8 6
126,500	100	„	4	Do. Do. 7½ p. c. Max.	153—163	..	2 9 1
489,200	Stck.	„	5	Do. Do. 5 p. c. Pref.	167—172	+2	2 18 1
1,019,585	„	15 Apl.	4	Do. 4 p. c. A Deb. Stk.	147—152	..	2 12 8
1,155,066	Stck.	12 June	10	West Middlesex	327—332	+5	3 0 2
200,000	„	„	4½	Do. 4½ p. c. Deb. Stk.	155—160	..	2 16 3

*Ex div.

Merthyr Tydfil Gas-Works.—The shareholders of the Merthyr Tydfil Gas Company have authorized the Directors to issue fresh capital for the purpose of providing for an extension of the gas-works A new retort-house is to be erected at a cost of about £5000.

The Ossett Corporation and the Gas Company.—The Directors of the Ossett Gas Company have declined the offer of the Corporation to purchase their property for the sum of £78,840. The Corporation have already resolved to apply to Parliament for power to purchase the undertaking compulsorily or otherwise, and alleges that the Company have exceeded their powers by the conversion of loan into 10 per cent. capital, as well as in other respects.

The Purchase of the Sandwich Gas-Works by the District Council.—The Sandwich Town Council have taken up the award for £4600 made by Mr. C. A. Cripps, Q.C., as the purchase price of the undertaking of the Sandwich Gas Company, to which reference was made last week. The date of the transfer was fixed for the 1st inst.; but as the Provisional Order sanctioning it has not yet received the Royal Assent, the Gas Committee of the Council have obtained a temporary advance of £5000 from the London and County Bank, paid the purchase money, and taken possession. The works are to be altered and improved.

Wokingham District Council Water Supply.—A Local Government Board inquiry has been held at Wokingham as to an application by the District Council for power to borrow £2000 for works of water supply. It was explained that the Council are carrying out some new works, and that the estimates of the Engineer (Mr. A. Marshall) has been most accurate, excepting in regard to the well. Unfortunately, the water was not obtained in such quantities as the advice of the geological expert had led him to hope; and it became necessary to expend a much larger sum on the well—£1300 in all, instead of the £500 first estimated. Then the inhabitants of Wargrave had begun to appreciate the water supply, and applied for an extension of mains, at an estimated cost of £1200, which, with the additional £800 for the well, made up the £2000 applied for.

Little and Graham's Retort-House Plant.—The Nelson Corporation have lately placed with Messrs. Little and Graham, Limited, of Smethwick, the contract for a new retort-house, and a complete range of inclined retorts. It includes the retort-benches, structural steel work, and the usual fittings, mains, valves, governors, engines, boilerl exhausters, economizer, condenser, scrubbers, purifiers, coal-breakers, conveyors, elevators, 20-ton and 10-ton weighbridges, and all other accessories for a complete system of inclined retorts. A special feature of the contract, which will be carried out under the supervision of the Gas Engineer to the Corportion (Mr. W. Foster), is the extensive conveyor and elevator plant to distribute the coke by means of three conveyors and elevators to three long batteries of coke storage-tanks, from which it is loaded automatically to the waggons or carts. At the Stalybridge Gas-Works, the firm are erecting, under the supervision of Mr. William Carr, the Engineer, 16 beds of nines, with horizontal furnaces.

The Explosion in Connection with the Birmingham Welsh Water Scheme.—H. J. Farley, one of the five men seriously injured in the blasting accident at the Bleddfa Tunnel, on the new water aqueduct of the Birmingham Corporation, died last Sunday week. The other four men are reported to be progressing favourably.

Coal and its Products.—At the Macintosh Hall, Port Elizabeth, Mr. W. Arnott, the Manager of the gas-works in that town, recently gave a lecture on "Coal and its Products." He explained in a very interesting manner the various processes in which coal is used, and the manufactures with which it is connected; his remarks being illustrated by a number of diagrams and experiments. He dealt with the method of obtaining aniline dyes from coal tar, and showed specimens of the different colours. He also alluded to the latest product from this residual of gas manufacture—saccharine—and exhibited and described a sample. Mr. Arnott was thanked for giving the lecture.

Artesian Borings for Water at Johannesburg.—Some time back, Mr. W. Dunbar received instructions from the Johannesburg Water Company to bring forward a scheme whereby a further supply of pure water might be secured for the town. Boring operations were commenced by Mr. Carl Mariager, with an American artesian drill; and we learn from the "Financial News" that a plentiful supply of pure water has been struck in several places at an average depth of 100 feet. The yield is at the rate of from 400,000 to 500,000 gallons a day. A further supply of about 20,000 gallons per 24 hours has been obtained above the old fountain at Doornfontein; and another bore-hole will be made in the vicinity. The formation of the ground here is similar to that at the other boring.

European Gas Company, Limited.—The annual general meeting of this Company was held yesterday. The report (the adoption of which was moved by the Chairman, Mr. J. Blacket Gill) stated that the consumption of gas at the Company's stations showed, in the aggregate, a slight increase compared with the previous year; but the total amount received for rental was a trifle less, owing to various reductions having been granted. A trial of prepayment meters had been made at Rouen and Bolbec. The results had been so far satisfactory; and, after further experience, the advisability of adopting the system at other stations will be considered by the Board. It was announced that the coal contracts had been renewed at reduced prices; and this had effected a considerable saving in the cost of the raw material. The return for coke was only slightly below that of last year; but sulphate of ammonia had again yielded a decreased profit. The Directors proposed the payment of a dividend of 20s. per share on the fully-paid shares, and 15s. per share on those £7 10s. paid, less the interim dividend of 8s. and 6s. per share paid respectively on Feb. 1 last. A bonus of 1 per cent. on all shares, according to the amount paid thereon, was also recommended. The payment of these would necessitate the withdrawal of £119 from the reserve of undivided profits. The motion was unanimously passed; and the dividend and bonus declared. The usual report of the proceedings will be published next week.

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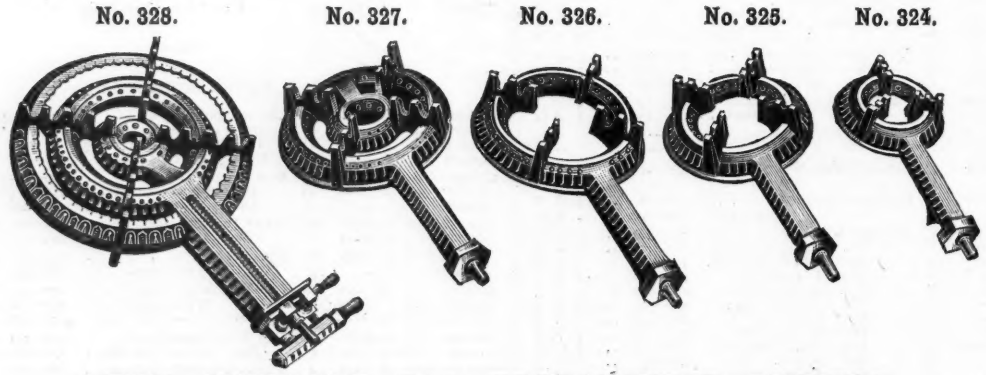

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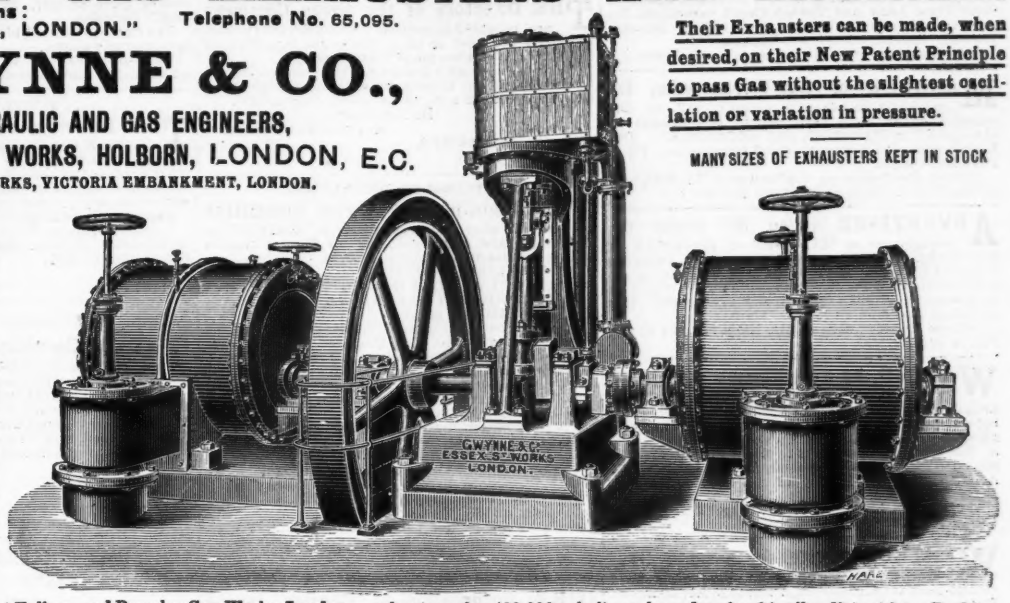

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120 and 121, NEWGATE STREET, LONDON, E.C.

Telegrams: "BOGORE, LONDON."

OXIDE OF IRON.

FINEST Quality of Natural Bog Ore. Particulars and price, apply to Mr. T. L. ARCHER, 20, Fennel Street, MANCHESTER.

SPENT OXIDE Wanted.

J. HARDMAN, Milton, STAFFS.

SULPHURIC ACID for Sale (B. O. V. and R. O. V.) made from Spent Oxide.

J. HARDMAN, Chemical Works, Milton, STAFFS.

CANNEL, COAL, ETC.

JOHN ROMANS & SON, EDINBURGH, Gas Engineers, supply all the most approved SCOTTISH CANNELS; also FIRE-CLAY GOODS, CAST-IRON PIPES, and other APPARATUS for GAS and WATER WORKS.

Prices, &c., will be forwarded on application to No. 30, ST. ANDREW SQUARE, EDINBURGH, / NEWTON GRANGE, NEWBATTLE, DALKEITH, } SCOTLAND.

TO EMPLOYERS, COMPANY DIRECTORS, ETC.

THE LAW GUARANTEE & TRUST SOCIETY, LD., GUARANTEES FIDELITY.

SEND for complete Prospectus containing Balance-Sheet, Copy of Policy, &c., &c. Mortgage, Debenture, License, and Contingency Insurance.

Head Office: 49, CHANCERY LANE, LONDON, W.C.

ECONOMY IN PURIFICATION.

INCREASE the Efficiency of your PURIFIERS by adopting CRIPPS'S PATENT BYE-PASS VALVE in the lower Tiers of Sieves. Practical Experience proves their Economy. Engineers are repeating orders after thorough trial.

References and Particulars can be obtained from the Makers—

C. & W. WALKER, Midland Iron-Works, Donnington, near Newport, SALOP.

And J. EVERY & SON, Phœnix Iron-Works, LEWES.

HYDRATED OXIDE OF IRON.

PREPARED from pure Iron.

Two or three times as rich as Bog Ore.
Strong action on Sulphuretted Hydrogen.
To be used alone, but will increase activity of other Oxides.
Less than half the price of Bog Ore.
Can be lent on hire.
Write for tabulated results.

READ HOLLIDAY AND SONS, LIMITED, HUDDERSFIELD.

SULPHATE OF AMMONIA SATURATORS.

JOSEPH TAYLOR & CO., Chemical Plumbers, &c., and Makers of every description of Solid Plate Lead and Timber Cased Saturators, &c. CENTRAL PLUMBING WORKS, TOWN HALL SQUARE, BOLTON. Special Attention to Repairs. Before placing Orders, please write for Estimate.

MANAGER of Gas-Works who, for perfectly satisfactory reasons, will be disengaged at an early date, desires appointment as MANAGER or MANAGER and SECRETARY. Ten Years' successful Working. Good Accountant. First-class References.

Further Particulars on application to No. 2679, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

ADVERTISER (aged 36) seeks re- engagement as MANAGER or FOREMAN in Gas-Works. Has 21 years' experience; is a thorough practical Man, well up in detail both in Manufacture and Distribution, and fair Draughtsman. No objection to go abroad. Speaks Spanish and Portuguese. Has excellent Testimonials for past Management.

Address No. 2676, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

WANTED, by a Gentleman who has a thorough practical knowledge of the Gas Trade including Gas-Fittings, Lamps, Chandeliers, Gas-Stoves, Tubes and Fittings, Gas-Meters, together with all accessories, who served his apprenticeship in one of the principal Gas-Works in Great Britain, and has travelled for 20 years, an appointment to REPRESENT A GOOD HOUSE in any of the above Branches. Highest References.

Address No. 2673, care of Mr. King, 11, Bolt Court FLEET STREET, E.C.

WANTED, at once, for a small Gas- Works connected with a Factory, a good second-hand GASHOLDER, 16 feet to 18 feet diameter. Quotations and Specifications for new one also invited.

Apply to the CHEDDAR VALLEY MANUFACTURING COMPANY, Cheddar, SOMERSET.

RETORT-HOUSE Foreman Wanted for a Gas-Works in Yorkshire, where about 30,000 Tons of Coal are Carbonized per Year. Wages, £2 per week. Preference will be given to one having had experience with Regenerative Furnaces and Stoking Machinery.

Applications to be sent to No. 2680, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

GAS PLANT.

WANTED, good Second-Hand Gas- HOLDER, 16 feet to 18 feet diameter.

Apply, by letter, giving full Particulars, Make, and Price, to No. 2675, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

FOR SALE — Retort Mouthpieces, D 16 in. by 14 in., ovals, 21 in. by 15 in.; 5-inch H-PIPES and DIP-PIPES; ASHPANS; also RECIPROCATING EXHAUSTER, about 8000 cubic feet per hour.

HENRY TOBEY, Gas-Works, Malton, YORKS.

SECOND-HAND BOILERS.

FOR SALE—Two Second-hand Cornish BOILERS, 10 ft. long by 3 ft. 6 in. diameter, each fitted with Double Safety-Valves, Steam Stop-Valve, Dampers, &c.

Full Information may be obtained and the Boilers seen at the Gas-Works, MAIDENHEAD.

HAMILTON CORPORATION GAS.

FOR SALE—Four Purifiers, 15 feet square by 4 feet deep, complete with Hydraulic Centre-Valve, 12-inch Connections and Hydraulic Lifting Apparatus; also a Round STATION METER, with 12-inch Connections, passing 23,000 cubic feet per hour.

The above are in first-class working order.

Further Particulars may be had from the undersigned.

WM. EWING,
Engineer and Manager.

Gas Office, Hamilton,
June 23, 1896.

STRATFORD-UPON-AVON CORPORATION.
(GAS DEPARTMENT.)

COAL CONTRACT.

THE Gas Committee invite Tenders for the supply of GAS COALS required during the ensuing Year.

Forms of Tender and full Particulars can be obtained upon application to

J. S. CRANMER,
Manager.

July 11, 1896.

BOROUGH OF ROCHDALE.

TO CHEMICAL MANUFACTURERS.

THE Gas Committee of the Corpora- tion invite TENDERS for the supply of such quantities of BROWN OIL OF VITRIOL as they may require during the ensuing Twelve Months.

The Acid to be made from Pyrites or recovered Sulphur, and to be delivered at the Rochdale Railway Station.

Further Information can be obtained from Mr. T. B. Ball, the Manager at the Gas-Works.

Tenders, endorsed "Vitriol," must be sent to me not later than Noon of Wednesday, the 22nd inst.

By order,
JAMES LEACH,
Deputy Town Clerk.

Town Hall, Rochdale,
July 11, 1896.

WAKEFIELD GAS COMPANY.

TENDERS FOR TAR.

THE Directors of the above Company are prepared to receive TENDERS for the surplus TAR produced at their Works for One, Two, or Three Years from the 1st of September next.

Tenders, endorsed "Tender for Tar," and addressed to the Chairman, to be sent to the undersigned not later than Eleven a.m., on Saturday, July 25, 1896.

H. TOWNSEND,
Engineer and Manager.

Gas-Works, Wakefield,
July 8, 1896.

BOROUGH OF DEWSBURY.

THE Lighting and Water Committee of the above Corporation invite TENDERS for the supply and delivery during the Twelve Months ending the 31st day of August, 1897, of—

(1) SULPHURIC ACID.
(2) WET AND DRY GAS-METERS.
(3) CAST-IRON GAS AND WATER PIPES.
(4) OXIDE OF IRON.

Specification and Forms of Tender may be obtained on application to the Gas Engineer, Mr. Chas. A. Craven, Gas-Works, Savile Town, Dewsbury.

Tenders, under sealed covers, endorsed "Sulphuric Acid," "Meters," "Cast-Iron Pipes," or "Oxide of Iron," as the case may be, to be sent to me not later than Saturday, the 18th inst.

The Corporation do not bind themselves to accept the lowest or any tender.

By order,
G. TREVELYAN LEE,
Town Clerk.

Town Hall, Dewsbury,
July 7, 1896.

BOROUGH OF CHORLEY.

TO TAR DISTILLERS AND OTHERS.

THE Corporation of Chorley invite TENDERS for the purchase of the surplus TAR produced at their Gas-Works for Twelve Months from the 1st of September next, delivered in Contractor's Tanks at either of the Chorley Railway Stations.

Any further Information may be obtained on application to Mr. John M'Cubbin, Gas Manager, Chorley.

The Corporation do not bind themselves to accept any tender.

Tenders, endorsed "Tar," to be sent to me on or before Tuesday, the 21st inst.

By order,
JNO. MILLS,
Town Clerk.

Town Hall, Chorley,
July 4, 1896.

BOROUGH OF CHORLEY.

THE Corporation of Chorley invite TENDERS for the supply of GAS COAL and NUTS and LIME required at their Gas-Works during a period of Twelve Months commencing the 1st of September next.

Forms of Tender for Coal and any further Information may be obtained on application to Mr. John M'Cubbin, Gas Manager, Chorley.

Tenders, duly endorsed, to be sent to me on or before Tuesday, the 21st inst.

The Corporation do not bind themselves to accept any tender.

By order,
JNO. MILLS,
Town Clerk.

Town Hall, Chorley,
July 4, 1896.

BOROUGH OF ILKESTON.

THE Gas Committee are prepared to receive TENDERS for the supply and delivery at their Gas-Works of 5500 Tons of GAS COAL between the 1st day of September next and the 31st day of August, 1897.

Conditions and Form of Tender may be had of the Manager (Mr. F. C. Humphrys), the Gas-Works, Rutland Street, Ilkeston.

Sealed endorsed tenders must be delivered to the undersigned by Five o'clock in the afternoon of Tuesday, the 21st day of July inst.

The Committee do not bind themselves to accept the lowest or any tender; and they reserve to themselves the right to divide the quantity above named into two or more Contracts.

By order,
WRIGHT LISSETT,
Town Clerk.

Town Hall, Ilkeston,
July 2, 1896.

TENDERS FOR TAR AND LIQUOR.

THE Directors of the Slough Gas and Coke Company are prepared to receive TENDERS for the purchase of the surplus TAR and AMMONIACAL LIQUOR (or either) produced at their Works, for a term of One Year ending the 30th of June, 1897.

The Slough Branch of the Grand Junction Canal is available.

The estimated quantities to be produced are: Tar, 30,000 Gallons; and Liquor, 30,000 Gallons.

The Products must be removed from the Works in Tank Carts.

Sealed tenders, stating Price for Tar per Barrel of 36 Gallons, and prices for Ammoniacal Liquor per 1000 Gallons of different strengths, at the Company's Works, and endorsed "Tender for Tar and Liquor," to be delivered on or before Tuesday, the 21st of July inst.

The Directors do not bind themselves to accept the highest or any tender.

ARTHUR THOMAS,
Secretary.

Slough, Bucks,
July 1, 1896.

THE Knutsford Light and Water Com- pany invite TENDERS for their production of AMMONIACAL LIQUOR for the Twelve Months ending June 30, 1897. State Prices for 5°, 5½°, 6°, 6½°, and 7° Twaddel.

The Company do not bind themselves to accept the lowest or any tender.

Tenders to be sent in on or before the 16th inst., addressed to the Chairman.

SURPLUS TAR.

THE Directors of the Ashford (Kent) Gas and Coke Company, Limited, are prepared to receive TENDERS for the purchase of the surplus TAR produced at their Works for One, Two, or Three Years from the 1st of September next. 30,000 gallons will be the approximate quantity.

Payments to be made monthly.

Tenders, endorsed "Tender for Tar," to be delivered at my Office, 11, Bank Street, Ashford, Kent, on or before Aug. 10, 1896.

F. HUGHES-HALLETT,
Secretary.

OSWALDTWISTLE URBAN DISTRICT COUNCIL.

THE Gas Committee invite Tenders for the TAR and LIQUOR produced at their Works for One Year from the 31st day of July, 1896.

The quantity of Coal carbonized is about 3500 Tons.

Further Particulars may be obtained from the Manager, Gas-Works, Church, near Accrington.

Tenders, endorsed "Tender for Tar," to be addressed to me, and to be delivered not later than Wednesday, the 29th of July.

WM. SANDEMAN,
Clerk.

District Council Offices,
Oswaldtwistle, June 26, 1896.

CAMBRIDGE UNIVERSITY AND TOWN GAS LIGHT COMPANY.

TENDERS FOR COAL.

THE Directors of the above Company are prepared to receive TENDERS for the supply of best well-screened GAS COAL, NUTS, and CANNEL, to be delivered between the 1st of August, 1896, and the 30th of June, 1897.

Forms of Tender and Specifications may be obtained on application to the undersigned.

Sealed tenders to be addressed to the Chairman not later than July 20, and endorsed "Tender for Coal."

The Directors do not bind themselves to accept the lowest or any tender.

By order,
O. J. WEEKS,
Manager.

Gas Office, Cambridge,
July 9, 1896.

THE Gas Committee of the Aberavon Corporation are prepared to receive TENDERS for the construction of a STEEL TANK and GAS-HOLDER. Dimensions as follows: Tank, 84 feet diameter by 27 feet deep; Gasholder, 80 feet diameter by 26 ft. 3 in. deep at the sides, with Cup prepared for Telescoping.

Each party tendering to furnish his own Designs and Specifications, and to take all responsibility of the Excavation, Concrete Foundation, and (if necessary) Piling.

Each tender to state total weight of Gasholder and Tank separately, which will be checked by the Corporation or other Weighing-Machine.

Site can be seen and further Particulars obtained by applying to Mr. G. W. Harrison, Gas Manager.

The whole work to be done to the satisfaction of the Gas Committee or whom they may appoint.

Sealed tenders, endorsed "Gasholder," addressed to the Chairman of the Gas Committee, to be sent to me not later than the 27th inst.

The Committee do not bind themselves to accept the lowest or any tender.

By order,
M. TENNANT,
Town Clerk.

Aberavon, Port Talbot,
July 1, 1896.

ISSUE OF STOCKS AND SHARES BY AUCTION UNDER PARLIAMENTARY POWERS.

MR. ALFRED RICHARDS undertakes the issuing by Auction of GAS AND WATER SHARES under Parliamentary Powers.

He also holds MONTHLY SALES of GAS AND WATER SHARES at the Auction Mart, Tokenhouse Yard, E.C.

Terms for the issuing of Capital, and also for offering to auction Gas and Water Shares, and all Particulars relating thereto, may be had of Mr. Alfred Richards.

Offices: 18, FINSBURY CIRCUS, E.C.

SALE ON MONDAY, JULY 27.

STOCKS AND SHARES IN GAS AND WATER COMPANIES AS FOLLOWS:—

Portsea Island Gaslight Company.
Barnet District Gas and Water Company.
Bournemouth Gas and Water Company.
Croydon Commercial Gas and Coke Company.
Southend Gas Company, Romford Gas and Coke Company, Limited, Goring and Streatley District Gas and Water Company, Walton-on-Thames and Weybridge Gas Company, and Grays Gas Company.

To be SOLD by AUCTION by

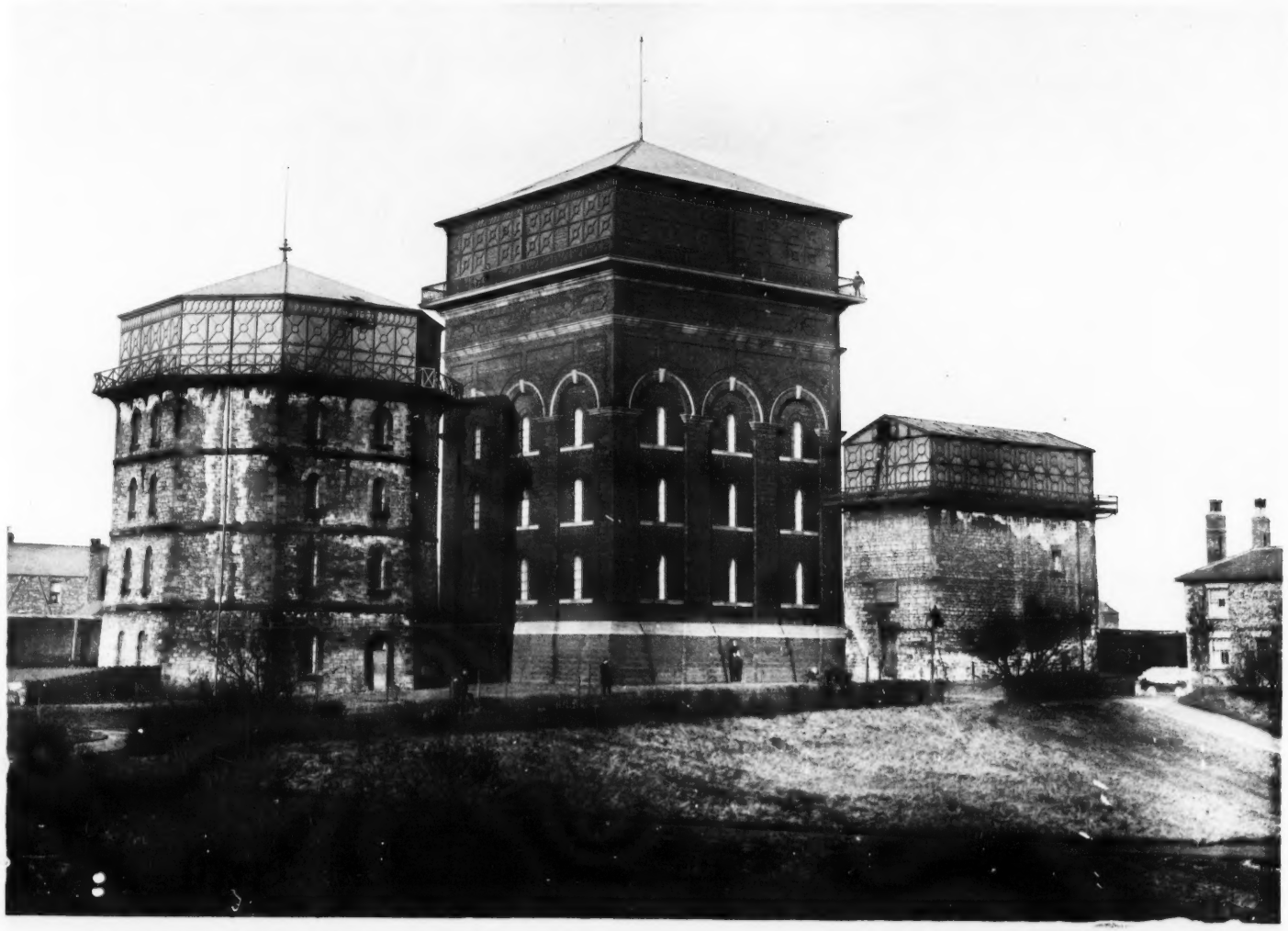
MR. ALFRED RICHARDS, at the Mart, London, E.C., on Monday, July 27, at Two for a quarter past Two, in Lots.

Particulars of the AUCTIONEER, 18, FINSBURY CIRCUS, E.C.

Advertisement Supplement to "THE JOURNAL OF GAS LIGHTING," July 14th, 1896.

THE WHESSOE FOUNDRY COMPY., LIMD.

ESTABLISHED 1790.



HARTLEPOOL WATER WORKS. T. BOWER, ENGINEER.

The WATER TANK, on the Central Tower, with Iron Roof, 60′ 0″ × 60′ 0″ × 17′ 9″

Total Weight 600 Tons,

WAS MADE AND ERECTED BY THE WHESSOE FOUNDRY COMPY., LIMD.

WORKS: DARLINGTON.

LONDON OFFICE: 28, QUEEN STREET, E.C.

LONDON: Printed by WALTER KING (at the office of King, Sell, & Railton, Ltd., 12, Gough Square); and published by him at 11, Bolt Court, Fleet Street, in the City of London—*Tuesday, July 14th, 1896.*

By order of the Directors.

TO TRUSTEES AND INVESTORS.

NOTICE OF SALE BY AUCTION BY

MESSRS. CRAWTER, at the Falcon Hotel, Waltham Cross, on Thursday, July 23 1896, at Six for Seven o'clock precisely, of £3150 PERPETUAL 4 per cent. DEBENTURE STOCK of the Waltham Abbey and Cheshunt Gas and Coke Company.

The last Half-Yearly Dividends have been at the rate of 7 per cent. per annum on the Original Share Capital of the Company. The increase in the Consumption of Gas during the last Four Years amounts to 10 million cubic feet; and, as the neighbourhood is rapidly developing, a further increase of Consumption may confidently be anticipated.

Particulars may be obtained of the SECRETARY of the Company, Waltham Abbey, ESSEX; at the place of Sale; and of Messrs. CRAWTER, Land Agents and Auctioneers, Cheshunt, HERTS.

Fcap. 4to, Cloth, price 7s. 6d., post free.

Practical Photometry.

By William Joseph Dibdin, F.I.C., F.C.S.

LONDON: Walter King, 11, Bolt Court, Fleet St., E.C.

Price 5s. per 100.

THE USE OF

GAS LIME IN AGRICULTURE.

By Dr. A. VOELCKER.

A 4pp. Leaflet for Distribution among Farmers and others.

LONDON: Walter King, 11, Bolt Court, Fleet St., E.C.

NOTICE.

The attention of the METEOR INCANDESCENT LIGHTING COMPANY, LIMITED, having been again called to the Advertisements inserted in various papers by the Incandescent Gas-Light Company, Limited, of Palmer Street, Westminster, to the effect that the "Meteor" Incandescent Gas-Lights are an Infringement of their Patents, and that they will bring Actions for Infringement against all persons found dealing in any manner with such Lights, the METEOR INCANDESCENT LIGHTING COMPANY, LIMITED, HEREBY GIVE NOTICE that they are advised that the "Meteor" Incandescent Lights in no way infringe any of the Patents of the Incandescent Gas-Light Company, Limited, that an action has been commenced to restrain such threats, and that they are PREPARED TO FULLY INDEMNIFY ALL PURCHASERS, DEALERS, AGENTS, and USERS of their Lights against any Legal Proceedings on the part of the Incandescent Gas-Light Company, Limited.

WILSON, BRISTOWS, & CARPMAEL

1, Copthall Buildings, London, E.C.,

Solicitors to the Meteor Incandescent Lighting Company, Limited, of 35, New Broad Street, London, E.C.

Nov. 30, 1895.

JAMES OAKES & Co.,

ALFRETON IRON-WORKS, DERBYSHIRE,

AND

Wenlock Iron Wharf, 21 & 22, Wharf Road, CITY ROAD, LONDON, N.,

Manufacture and keep in Stock at their Works (also large stock in London)

PIPES and CONNECTIONS, 1½ to 48 inches in diameter, and make and erect to order RETORTS, PURIFIERS and TANKS, with or without planed joints, COLUMNS, GIRDERS, SPECIAL CASTINGS, &c., required by Gas, Water, Railway, Telegraph, Chemical, Colliery, and other Companies.

NOTE.—Makers of HORSLEY'S PATENT SYPHONS. These are cast in one piece, without Chaplets; doing away with bolts, nuts and covers, and rendering leakage impossible.

THOMAS TURTON AND SONS, LIMITED,

SHEAF WORKS, SHEFFIELD,

MANUFACTURERS OF

FILES OF BEST QUALITY

FOR ENGINEERS.

STEEL OF ALL DESCRIPTIONS.

SCREW STOCKS, TAPS AND DIES,
SPANNERS, RATCHET BRACES, LIFTING JACKS,
ANVILS, VICES,
AND ENGINEERS' TOOLS GENERALLY.

LONDON OFFICE:

90, CANNON STREET, E.C.

THORNLEY GAS COALS

WORKED BY THE

WEARDALE IRON & COAL Co., Ld.

OUT OF THEIR

THORNLEY AND WHEATLEY HILL COLLIERIES.

Analysis made by

Messrs. J. & H. S. PATTINSON, *May 28, 1895.*

Yield of Gas per Ton . .	10,500 Cub. Ft.
Illuminating Power . .	16·9 Candles.
Coke (of good quality) . .	67·5 per Cent.
Sulphur	0·58 ,,
Ash	2·73 ,,

For Price, &c. apply to the

WEARDALE IRON & COAL Co., Ld.

QUAYSIDE, NEWCASTLE-ON-TYNE.

LONDONDERRY GAS COALS

FROM THE

MARQUIS OF LONDONDERRY'S COLLIERIES,

COUNTY OF DURHAM.

Available output up to 5000 tons per day.
Yield of Gas 11,000 cubic feet per ton of Coal as per analysis by
Mr. John Pattinson, F.C.S., F.I.S.

FOR PRICES AND PARTICULARS, APPLY TO

S. J. DITCHFIELD,

SEAHAM HARBOUR, COUNTY OF DURHAM.

HOLMSIDE GAS COALS.

PRESENT DAILY PRODUCE OVER 4000 TONS.

LATEST ANALYSIS—By CHARLES PHILLIPS, Gas Examiner to Rotherham Corporation.

Yield of Gas Per Ton . .	11,205 Cubic Feet.
Illuminating Power,	16 7/10 Stand. Sperm. Candl.
Coke (of good & pure quality)	13¾ Cwt. Per Ton.
Sulphur	A little over 1 Per Cent.
Ash	Under 1 Per Cent.
Tar	163 Lbs. (Avoir.) Per Ton.
Ammoniacal Liquor	103 Lbs. (Avoir.) Per Ton.

HOLMSIDE GAS COALS are supplied to the largest Gas Companies in England and on the European Continent; London alone consuming about half the produce.

SOUTH MOOR PELTON GAS COALS.

PRESENT DAILY PRODUCE AVAILABLE 2500 TONS.

RESULTS OF DIFFERENT ANALYSES:—

Yield of Gas Per Ton . .	10,500 Cubic Feet.
Illuminating Power .	17 Stand. Sperm Candl.
Coke (of excellent quality) .	13½ Cwt. Per Ton.
Sulphur	1·13 Per Cent.
Ash.	1·34 Per Cent.
Tar.	180 Lbs. (Avoir.) Per Ton.
Ammoniacal Liquor	94½ Lbs. (Avoir.) Per Ton.

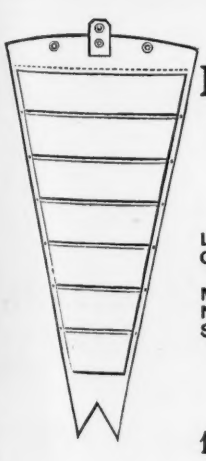
The HOLMSIDE and SOUTH MOOR COALFIELD possesses *a very great quantity of the best Coal;* and, whilst other Coal-Fields are becoming exhausted, this one is only being opened out, so that *the quality* of both the HOLMSIDE COALS, and the SOUTH MOOR COALS *may be relied upon for all practical purposes.*

These Coals may be bought through the Principal Merchants in England, or direct from

MR. MARK ARCHER,

HOLMSIDE AND SOUTH MOOR OFFICES,

NEWCASTLE-UPON-TYNE.



H. KIRKHAM'S

PATENT

BASKET OR CAGE

For Holding Material in Scrubber-Washers.

ADVANTAGES:

Lightness.
Cages removed, and fresh ones substituted in a few hours.
Machines easily cleaned.
No stopping for long periods.
Saving in Labour and Power.

Full Particulars on application at

335, MANSION HOUSE CHAMBERS,
11, QUEEN VICTORIA ST., LONDON, E.C.

GRICE'S SELF-SEALING MOUTHPIECE,

FITTED WITH WROUGHT-IRON FRONT AND SIDE LEVERS.

Patterns for Oval, D, and Rounds, or all sized Retorts.

Catalogue and Price on application.

WILLIAM GRICE & SONS,

FAZELEY STREET WORKS, BIRMINGHAM.

THE INCANDESCENT GAS-LIGHT COMPANY, LIMITED,
— *v* —
"DE MARE" COMPANY.

THE INCANDESCENT GAS-LIGHT COMPANY, LIMITED.
— *v.* —
"SUNLIGHT" COMPANY.

THE INCANDESCENT GAS-LIGHT COMPANY, LIMITED, HEREBY GIVE NOTICE, as follows:—

VALIDITY. The Company's Patent has been declared VALID ON ALL POINTS after a Fifteen-Day Trial.

NATURE OF INVENTION. The Invention was described by Mr. Justice Wills as a "PIONEER INVENTION."

SCOPE OF PATENT. The Patent HAS BEEN GIVEN A WIDE CONSTRUCTION; and it was held that the protection given by it was not confined to Mantles manufactured according to the particular prescriptions set out in the Specification.

SHAPE OF MANTLE. The Judge held that a Mantle, even if made in a different form or shape (such as the "De Mare" Fringe or Plume), IS STILL AN INFRINGEMENT of the "Welsbach" Patent.

"DE MARE" JUDGMENT. Judgment for an INJUNCTION, WITH FULL COSTS, has been given against the "De Mare" Incandescent Gas-Light System.

"SUNLIGHT" JUDGMENT. Judgment was given AGAINST the "Sunlight" Incandescent Gas-Lamp Company, Limited, on the question of the VALIDITY OF THE PLAINTIFFS' PATENT.

"SUNLIGHT" MANTLES. Last about 100 hours.

"WELSBACH" MANTLES. Last about 1000 hours.

"Sunlight" Mantles BURN DOUBLE THE GAS to produce the same candle power as the Incandescent Gas-Light Company's Mantles.

Users of "Sunlight" Mantles are applying to the Incandescent Gas-Light Company to REPLACE THEM BY THEIR OWN MANTLES.

WARNING. Users of the Incandescent Gas-Light Company's Mantles upon "Sunlight" Burners ARE INFRINGERS OF THE COMPANY'S PATENT, AND WILL BE AT ONCE PROCEEDED AGAINST.

COSTS. Certificates of the Validity of the Company's Patent have been granted both by Mr. Justice Romer and Mr. Justice Wills entitling the Company to Solicitor and Client Costs, which will, IN ALL CASES, BE RIGOROUSLY ENFORCED.

INFRINGERS. The Incandescent Gas-Light Company WILL TAKE PROCEEDINGS AGAINST ALL PERSONS INFRINGING THEIR PATENT, WHETHER
MAKERS,
WHOLESALE DEALERS,
RETAILERS,
or
USERS.

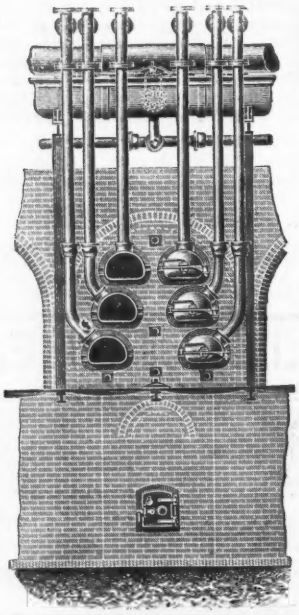
Users of the Company's Mantles upon Burners not sold by the Company ARE INFRINGERS.

"LIMITED LICENSE" WARNING. Judgments have already been obtained against such users from Mr. Justice Chitty, Mr. Justice Stirling, Mr. Justice Kekewich, and Mr. Justice North.

FAITHFULL & OWEN,
11, Victoria Street,
Westminster.
Solicitors to the Incandescent Gas-Light Company, Limited.

April, 1896.

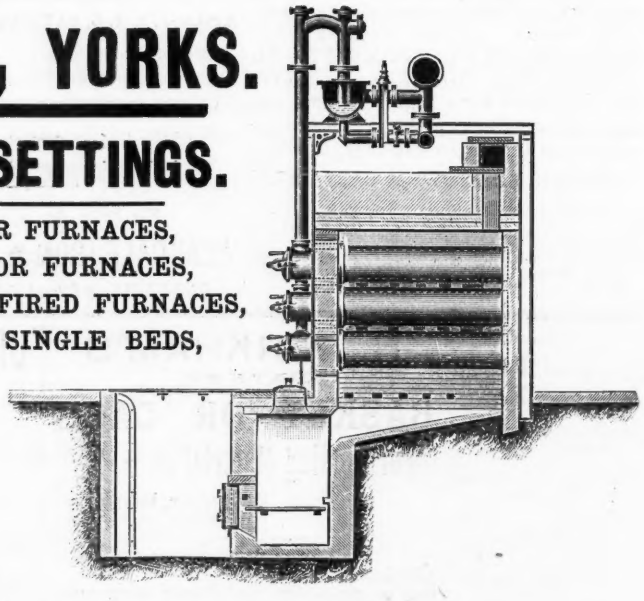
R. DEMPSTER & SONS, L^D.



ELLAND, YORKS.

RETORT-SETTINGS.

GENERATOR FURNACES,
REGENERATOR FURNACES,
SIMPLE DIRECT-FIRED FURNACES,
THROUGH & SINGLE BEDS,
SUITABLE FOR
LARGE
OR
SMALL
GAS-WORKS.



CONTRACTS FOR COMPLETE INSTALLATIONS.

GIVING THE HIGHEST WORKING RESULTS, THE MOST PERFECT HEATING, GREATLY INCREASED DURABILITY, THE LOWEST FUEL CONSUMPTION.

PLANS AND ESTIMATES ON APPLICATION.

TROTTER, HAINES, & CORBETT,
Brettell's Estate
FIRE-CLAY & BRICK WORKS,
STOURBRIDGE.

Manufacturers of GAS-RETORTS, GLASSHOUSE FURNACE & BLAST-FURNACE BRICKS, LUMPS, TILES, and every description of FIRE-BRICKS.
Proprietors of
BEST GLASSHOUSE POT & CRUCIBLE CLAY.
Shipments Promptly and Carefully Executed.

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CANNEL COAL MERCHANT,
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Prices and Analysis of all the Scotch Cannels on Application.

BOLDON GAS COALS.
Worked by THE HARTON COAL CO., LTD.
Output about 3000 tons per day.

Analysis—

Yield of Gas per ton	10,500	Cubic Feet.
Illuminating Power	16·9	Candles.
Coke	66·7	Coke.
Sulphur	0·86	Sulphur.
Ash	2·04	Ash.

Boldon Gas Coals are supplied under contract to

The Gaslight and Coke Company, South Metropolitan Gas Company, Commercial Gas Company, Imperial Continental Gas Association, European Gas Company, L'Union des Gaz (the Continental Union Gas Company), Crystal Palace District Gas Company, Danish Gas Company, Bombay Gas Company, San Paulo Gas Company, Alliance and Dublin Consumers' Gas Company, Ipswich Gaslight Company, Newcastle Gas Company, Sunderland Gas Company, South Shields Gas Company, and to many other Companies at Home and Abroad.

For Prices, &c., apply to the
HARTON COAL COMPANY,
LIMITED,
Newcastle-on-Tyne.
W. H. PARKINSON,
Fitter.

LITTLE & GRAHAM, Ld.

THE
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SPECIALISTS

TRANSPORT APPLIANCE WORKS,
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MIRFIELD
BLACK BED GAS COAL.
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RAVENSTHORPE, near DEWSBURY.

HUNTER'S
OXIDE OF IRON.
James Hunter, Miner, and Shipper of
NATURAL IRISH BOG ORE.
This Estate yields the finest and most uniform quality in Ireland; and the quality is guaranteed.
Samples and Prices on application.
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Telegrams: "Hunter, Port Glasgow."
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CANNEL & COAL.

TYNE
BOGHEAD CANNEL.

Yield of Gas per ton	13,155 cub. ft.
Illuminating Power	38·22 candles.
Coke per ton	1,301·88 lbs.

EAST PONTOP GAS COAL.

Yield of Gas per ton	10,500 cub. ft.
Illuminating Power	17·8 candles.
Coke	70 per cent.

SOUTH PELAW MAIN GAS COAL.

Yield of Gas per ton	10,500 cub. ft.
Illuminating Power	16·3 candles.
Coke	73·1 per cent.

For Prices and complete Analysis, apply to
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Coal Owners, Newcastle-on-Tyne;
or
E. FOSTER & CO.,
12, John Street, Adelphi, London, W.C.

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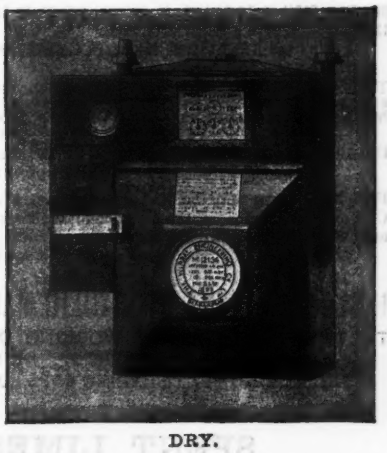
Patent New Prepayment Meters.

WET.

THE
"PERFECT"
AUTOMATIC.

Simple! Positive!! Accurate!!!

The only Prepayment Meter with no Springs, Counter-Balance Weights, or Frictional Gearing to get out of order.



DRY.

Particulars on Application to the COMPANY, 8, Tower Chambers, LIVERPOOL.

HEBBURN MAIN GAS COALS.

Yield of Gas per ton . . . . . 10,500 cub. ft.
Illuminating Power . . . . . 16·4 candles.
Coke . . . . . 68 per cent.

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COKE-BREAKERS,

PRICES REDUCED.
(THOMAS & SOMERVILLE'S PATENT)
New Design, with two Cutting Rollers, making less Breeze than their old pattern.

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And at STROUD, GLOUCESTERSHIRE.

NEWBATTLE CANNEL.

Highest Results in Gas, & Excellent Coke.

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NEWBATTLE COLLIERIES,
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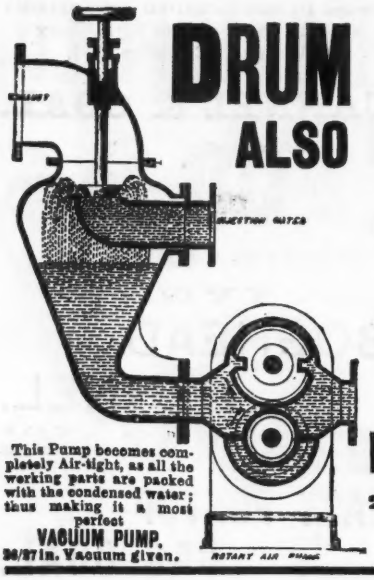
"The Force of the Piston Pump with the Capacity of the Centrifugal combined."

JOHNSON'S PATENT

DRUM PUMP AND EXHAUSTER
ALSO VACUUM PUMP AND CONDENSER.

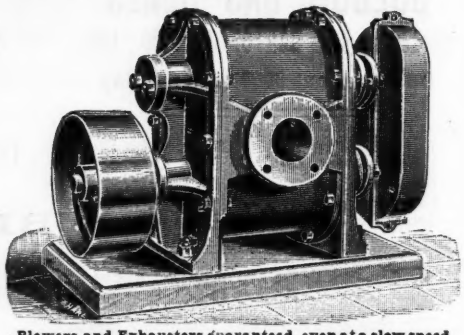


This Pump becomes completely Air-tight, as all the working parts are packed with the condensed water; thus making it a most perfect
VACUUM PUMP.
30/27 in. Vacuum given.

No Priming, Valves, or Frictional Working Parts.

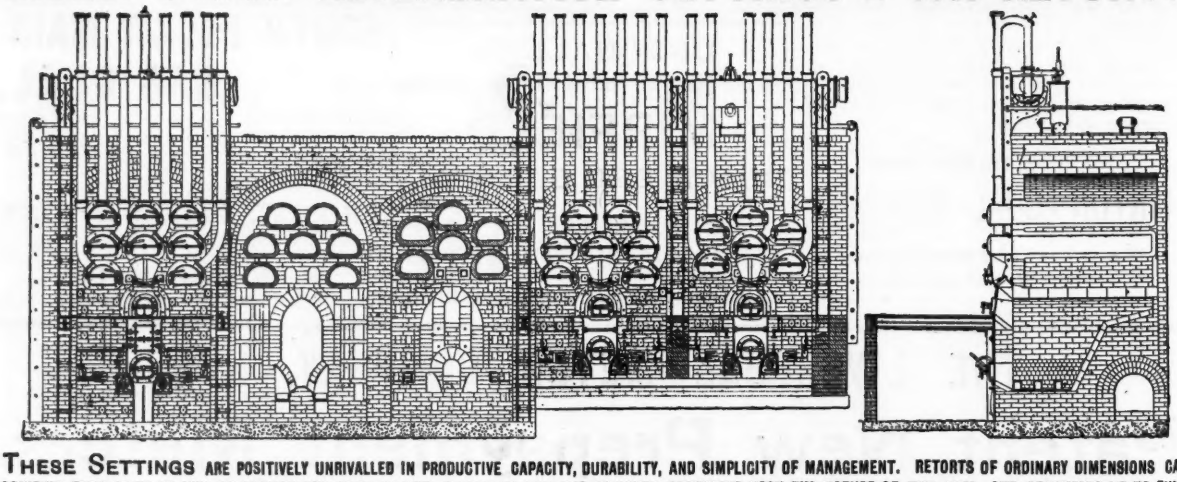
The Pump of the future for quickly and economically moving large Bodies of Water, Semi-fluid, &c.

DRUM ENGINEERING Co.
27, CHARLES ST.,
BRADFORD.



Blowers and Exhausters guaranteed, even at a slow speed, to give a working pressure of 3 lbs. and upwards, and this without losing power by creating frictional Heat.

HISLOP'S PATENT REGENERATIVE SETTINGS OF GAS-RETORTS.



THESE SETTINGS ARE POSITIVELY UNRIVALLED IN PRODUCTIVE CAPACITY, DURABILITY, AND SIMPLICITY OF MANAGEMENT. RETORTS OF ORDINARY DIMENSIONS CARBONIZING FROM 18 TO 24 CWT. OF ENGLISH AND 21 TO 26 CWT. OF SCOTCH COAL PER 24 HOURS, DEPENDING UPON THE NATURE OF THE COAL, AND PRODUCING UP TO FULLY 13,000 CUBIC FEET PER MOUTHPIECE IN THE SAME TIME, AND WITH THE SMALLEST EXPENDITURE OF FUEL ATTAINABLE, AND RETURNING IN PROFIT THE ENTIRE COST OF ERECTION WITHIN TWELVE TO EIGHTEEN MONTHS; AND THUS REDUCING TO INSIGNIFICANCE THE INCREASED COST OF THESE SETTINGS OVER THE COMMON OR GENERATOR FURNACE SYSTEMS.

THESE SETTINGS ARE EXTENSIVELY ADOPTED, AND ARE ERECTED UPON THE SHALLOW AND STAGE FLOOR PLANS. THEY ARE ADAPTED TO ANY EXISTING ARRANGEMENTS, AND PERFECT SATISFACTION GUARANTEED. THE COMPOSITION OF FIRE-RESISTING AND OTHER SPECIAL FIRE-CLAY MATERIALS FURNISHED IS OF THE HIGHEST ORDER: AND THE SYSTEM AS A WHOLE, AS NOW PERFECTED, IS THE RESULT OF LONG EXPERIENCE AND CAREFUL STUDY OF THE PRINCIPLES OF GASEOUS FIRING.

Drawings and Tenders are furnished for the complete erection of Benches, including Retort and Bench Mounting of the most modern and approved description; or existing Ovens fitted up with the Patentee's arrangements.

Full Particulars may be had on application to the Patentee's Agents: Messrs. JONAS DRAKE AND SON, Retort Setters and General Carbonizing Engineers, Ovenden, Halifax, Yorkshire, Sole Agents for England, Wales, and Foreign Countries; C. M. HAMILTON, Retort Setter and Contractor, 5, Stuart Street, Shawlands, Glasgow, Agent for Scotland and Ireland; and to the Principal Agent, R. F. HISLOP (Son of Patentee), General Constructing and Carbonizing Engineer, Gas-Works, Paisley, N.B.

HISLOP'S PATENT HYDRAULIC MAIN SEAL-REGULATING AND TAR-EXTRACTING VALVE is a *Sine qua non.*

TO THE SATISFACTORY WORKING OF THE HYDRAULIC MAIN UNDER THE REGENERATIVE AS WELL AS OTHER SYSTEMS OF RETORTS. BEING LARGELY ADOPTED AND AFFORDING THE HIGHEST SATISFACTION.

The Patentee's SELF-SEALING CAPS FOR THE TOP OF ASCENSION-PIPES, and his "SPECIAL" FLUE PORT BOXES, are most important additions to his Carbonizing Plant.

SPENT LIMES NO LONGER WASTE PRODUCTS.

Under G. R. HISLOP'S Patents, all Spent Limes are effectively recovered at from one-third to one-half the cost of New Lime.
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RICH IN ILLUMINATING POWER AND YIELD OF GAS.

ABOVE THE AVERAGE IN WEIGHT AND QUALITY OF COKE.

MAINTAINS A HIGH STANDARD IN RESIDUALS.

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LAMP TORCHES.

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STREET LAMPS & POSTS.

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Airedale	Cobham
Aldridge	Coleshill
Alfreton	Colombo
Antrim	Collingham
Armagh	Colney Hatch
Ascot	Coventry
Aylsham	Cranbrook
Ballymena	Cullen
Beaumaris	Deddington
Bentham	Dewsbury
Bewdley	Downpatrick
Bideford	Dursley
Birmingham	East Ardsley
Blackburn	Eastbourne
Bognor	Elland
Bollington	Ellesmere
Boreham	Elstree
Bramham	Eye
Brandon	Farnham
Bridgnorth	Felixstowe
Broadgreen	Garston
Broadstairs	Gillingham
Bromsgrove	Gorey
Broughty Ferry	Halesowen
Builth	Hanley
Burton	Hendon
Buxton	Hinckley
Cannock	Holywood
Carlow	Honiton
Castleford	Huelva
Chester le Street	Huntingdon

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PAINTS FOR GASHOLDERS.

Contractors to Her Majesty's Government, the Indian Government, the Natal Government, the Turkish Government, the Netherlands Railway, the London County Council, &c., &c.

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Guaranteed genuine and free from adulteration, and specially made to withstand Gaseous Fumes.

Catalogue and Testimonials on Application.

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Kilrush	Seisdon
Kildwick	Shifnal
Kirkburton	Shipston-on-Stour
Knutsford	Sidmouth
Leamington	Skibbereen
Ledbury	Slough
Leek	Southam
Leven, N.B.	Southend
Limerick	Stafford
London	Stamford
Loughborough	Strood
Lymington	Stroud
Merthyr Tydfil	Swinton
Milborne Port	Sudbury
Napier (N.Z.)	Tetbury
North Middlesex	Tokio
Outlane	Uppingham
Pembroke	Uttoxeter
Penmaenmawr	Ventnor
Portadown	Warwick
Port Elizabeth	Wexford
Portrush	Wigston
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Ramsey	Wollaston
Raunds	Wolverhampton
Richmond	Workington

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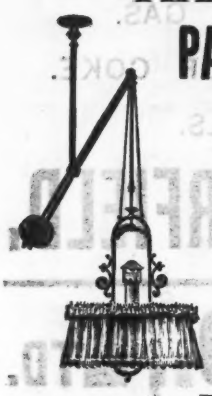
THE



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The ONLY GAS-PENDANT suitable for Domestic Lighting; a room 18 ft. by 14 ft. being beautifully illuminated with one Incandescent Burner.

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ON THE CONTINUOUS SYSTEM

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Old Systems easily and cheaply converted.

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FACE YOUR RETORT MOUTHPIECES.

Main Drilling Stand, with Cup Drills, 1¼ to 6 inch; Taps, Rymers, and Drills.

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Ratchet Screwing Stocks and adjustable once-up Stocks, Dies, Guides, &c.

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—DRY METER.—

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Have constructed their EUROPEAN type of

CARBURETTED WATER-GAS PLANT

At the following Gas-Works:—

Copenhagen	700,000 Cub. Ft.	Liverpool	2,500,000 Cub. Ft.
Belfast	1,700,000 „	Brighton	1,250,000 „
Glasgow	300,000 „	Bath	1,000,000 „
Brussels	700,000 „	Preston	1,500,000 „
Santiago	400,000 „	Southport	750,000 „
Swansea	700,000 „	New York	1,000,000 „
Tottenham	600,000 „	Newburgh, N.Y.	350,000 „

And have now under Contract:—

Belfast (Second Contract)	3,500,000 Cub. Ft.	St. Joseph, Mo.	750,000 Cub. Ft.
Edinburgh	2,000,000 „	Holyoke, Mass.	500,000 „
Tottenham (Second Contract)	750,000 „	Shanghai	225,000 „
Winchester	200,000 „	Stockton-on-Tees	600,000 „
Hoylake	125,000 „	Stockport	600,000 „
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In addition to which the previous Installations of The Gaslight and Coke Company under this System have a total capacity of 10,000,000 cubic feet per diem.

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Analysis: 12,600 Feet of 19-Candle Gas per Ton.

Value in Pounds of Sperm, 820·80.

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RETORT SETTERS. FURNACE BUILDERS.

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Established 1860.

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UPPER GROUND STREET, LONDON, S.E.,
SUPPLY FROM STOCK
CAST-IRON RETORTS,
AND ALL KINDS OF GAS-WORKS APPARATUS.
SOCKET-PIPES FOR GAS OR WATER PURPOSES.
FLANGE PIPES FOR STEAM.
Sole Manufacturers of LYON'S "PATENT" GAS-MAIN SYPHONS.
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BEST QUALITY.
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[See Illustrated Advertisement, July 7, p. 52.]

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Have confidence in drawing the special attention of GAS ENGINEERS to the following advantages of their Retorts:—
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2. They can be made in one piece up to 10 feet long.
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Patent Automatic Machinery
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[See Illustrated Advertisement, July 7, p. III.]

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COMPLETED IN 12 MONTHS
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SPECIALITY
IT IS 300 FT DIAR. HAS SIX LIFTS, EACH 30 FT DEEP. HAS NO ROPES OR SPIRAL GUIDES.
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GAS PLANT WORKS, NEWTON HEATH, MANCHESTER.

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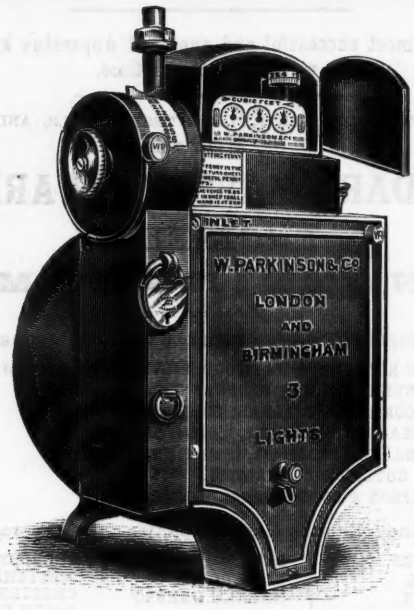

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Adapted for use with PENNIES, SHILLINGS, or other English or Foreign Coins.

PRICE-CHANGING EFFECTED IN THE SIMPLEST MANNER AND WITH ABSOLUTE EXACTITUDE.

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Telegraphic Addresses {"INDEX, LONDON." "GAS METERS, BIRMINGHAM."

Telephone Numbers (National) {London 7778. Birmingham 1101.

[See also Advt. p. 60.

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